

THE FERN GENUS *ELAPHOGLOSSUM* SCHOTT (FILICALES) IN SOUTH AFRICA

J. P. ROUX

(Drakensberg Botanic Garden, P.O. Box 157, Harrismith 9880, R.S.A.)

ABSTRACT

The morphology, habitat, distribution and ecology of the eight *Elaphoglossum* species which are known to occur within the flora of South Africa area are discussed and a systematic treatment of the taxa is provided.

UITTREKSEL

DIE VARING GESLAG *ELAPHOGLOSSUM* SCHOTT (FILICALES) IN SUID-AFRIKA

Die morfologie, habitat, verspreiding en ekologie van die agt *Elaphoglossum* spesies wat binne die flora van Suid-Afrika area aangetref word, word bespreek. 'n Taksonomiese verhandeling van die betrokke spesies word ook weergegee.

INTRODUCTION

The classification and the position of the fern genus *Elaphoglossum* in the systematic scheme always was and still remains a subject of much debate. Although no agreement has yet been reached as to where *Elaphoglossum* fits into the overall systematic scheme, most recent pteridologists tend to place *Elaphoglossum* in a position near or between the dryopteroid and davalloid ferns. The position is largely due to cytological evidence.

The generic breakdown and the species concept in *Elaphoglossum* is largely hampered by the uniformity and simplicity in gross morphology of the approximate 400 known species.

The author believes that a system of generic breakdown and a systematic treatment of the genus is not possible unless a better understanding can be formed of the characters on which species discrimination is commonly based. It is for this reason that the characters are individually discussed. The author trusts that it will contribute to and help promote further studies on the characters in other parts of the world which will lead to a better understanding of the genus *Elaphoglossum*.

In the taxonomic part the author has investigated the statements of Schelpe (1969), and has to report three corrections.

- i. *Elaphoglossum conforme* var. *latifolium* Sim is a synonym of *E. angu-*

tatum (Schrad.) Hieron. and not of *E. macropodium* (Fée) Moore. A new lectotype is also proposed for this taxon.

ii. *Acrostichum piloselloides* Presl is not a synonymous with *E. spathulatum* (Bory) Moore. (See p. 515).

iii. *Acrostichum lineare* Fée is a synonym of *E. aubertii* (Desv.) Moore; this is a new observation.

HISTORICAL REVIEW

Long before and even after the generic name *Elaphoglossum* was established all ferns which appeared to have acrostichoid soriation were commonly placed in the genus *Acrostichum*. Schott (1834), without description, proposed the name *Elaphoglossum* but it was not formally described until 1841 by J. Smith.

Fée (1845) was the first to prepare a treatment of the genus in his *Histoire des Acrosticées* (Mém. Fam. Foug. 2). The elaphoglossoids were divided into two groups; *Oligolepideae* and *Polylepideae*. Later, in his *Genera Filicum* (Mém. Fam. Foug. 5), Fée (1852) used four primary groups without further subdivision; *Oligolepideae*, *Polylepideae*, *Pilosellae* and *Chromatolepideae*.

The genus name *Elaphoglossum* was not widely accepted but was first used extensively by Moore during the period 1857–1862. His generic breakdown consists of *Oligolepidium*—fronds naked, or with few scales and *Polylepidium*—fronds clothed with numerous scales.

The classic *Monographie des Genus Elaphoglossum* of Christ (1899), stands as the most detailed treatment of the genus, covering 142 species in 32 groups. The primary division was based on venation. In ordo *Stenoneura* the veins run all the way to the margin without thickened vein ends, whereas ordo *Condyloneura* have veins ending short of the margin and they are swollen. The ordos were further subdivided into sections, subsections and divisions.

Bower (1928) on the other hand, referred the genera previously treated as members of the Acrostichae as belonging to different groups of ferns. *Elaphoglossum* belongs to his metaxyoid ferns of which *Metaxya* is the most primitive and *Elaphoglossum* the most advanced genus.

Christensen (1938), gave it its own subfamily, Elaphoglossoideae in the Polypodiaceae-Dryopteroidae. Copeland (1947), placed *Elaphoglossum* as part of the family Aspidiaceae. In the same year, Holttum, because of the dorsiventral scaly rhizome, the free, or nearly free veins, the acrostichoid soriation and spores, placed *Elaphoglossum* in close association with *Lomariopsis*. The subfamily Lomariopsidoideae formed part of his Dennstaedtiaceae. Alston, in 1956, raised the subfamily Lomariopsidoideae to family level.

When dealing with the Malesian species of *Elaphoglossum*, Holttum (1966) proposed a preliminary, very simplified scheme for the subdivision of the genus. This system was entirely based on scale characters.

Pichi Sermilli (1968) created Elaphoglossaceae, an independent family, an entity belonging to the stock of Aspidiales. This was largely due to cytological evidence. He did not recognise it as being closely related to any other family of that order.

His argument is primarily based on differences between *Elaphoglossum* and *Bolbitis* but ignored Holttum's comment that it shows close resemblance to *Lomariopsis*. Frond architecture, frond phylogeny, articulation, venation, sori, spores, gametophyte characters and the habit were the major characters which came under consideration.

Lovis (1977) also placed *Elaphoglossum* in the Lomariopsidaceae, a position between the dryopteroid and davalloid ferns. The dryopteroid relationship was first suggested by Copeland (1947), while the davalloid relationship, especially the Oleandroideae of Lovis, are similar in stele and chromosome number to the Lomariopsidaceae.

Mickel and Atehortúa (1980) revised the system of generic breakdown by subdividing the genus into sections and subsections only. They now recognise 9 sections and 21 subsections, many of which are new.

They also found the spores of *Elaphoglossum* similar to those of *Oleandra* and *Arthropteris* (illustrated by Liew, 1977).

The relationship of *Elaphoglossum* to the other lomariopsidoid ferns remains ambiguous. Holttum (1947) placed it in association with *Lomariopsis* for reasons already stated. Copeland (1947) did not recognise any near relatives, except for two small genera, *Microstaphyla* and *Rhipidopteris*, both of which are now included in *Elaphoglossum* (Mickel, 1980; Mickel & Atehortúa, 1980).

DIMORPHISM

Dimorphism is a character commonly used for species discrimination in *Elaphoglossum*. The term, as used here, embraces various features which differ from the sterile to the fertile frond. Frond architecture and orientation, stipe articulation, frond scales and venation patterns show significant dimorphic values and will be discussed below.

RHIZOME

In all the relevant taxa the rhizome is creeping. The shape of the rhizome shows variation. It may be slender, with two rows of often widely spaced approximate fronds [e.g. *E. angustatum*, *E. acrostichoides*, *E. coniforme*, *E. drakensbergense*, *E. macropodium* and *E. spatulatum* (Fig. 1)]

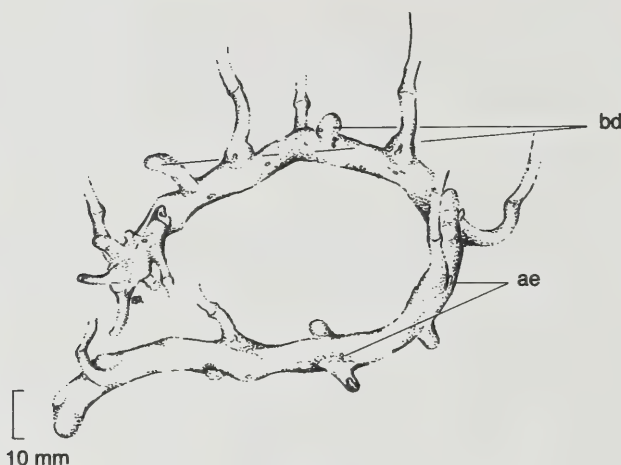


FIG. 1.

Habit of a dorsiventral rhizome, scales removed. *E. angustatum*, Roux 773 (NBG).
ae: aerophores; bd: buds.

or short creeping, stout, and usually with four rows of caespitose fronds (e.g. *E. aubertii* and *E. hybridum*).

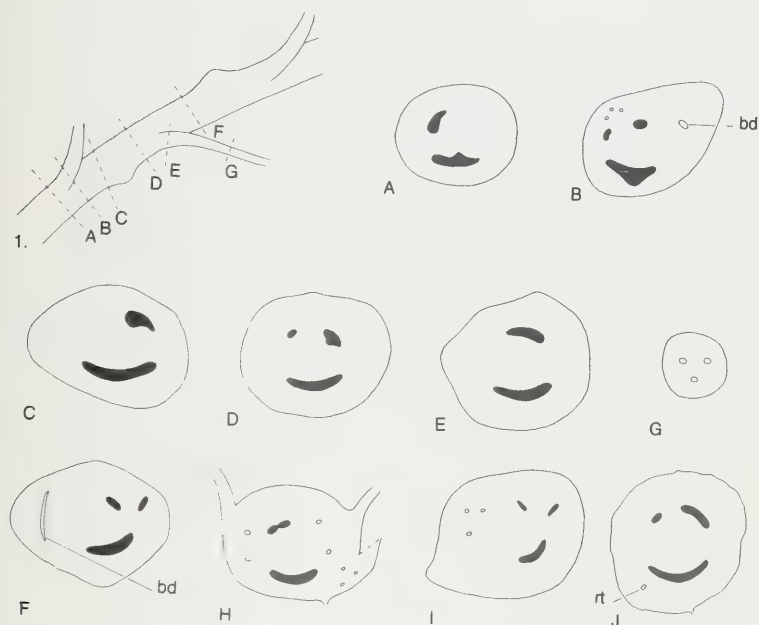
In some species conspicuous buds are situated on the rhizome on the posterior side of the phyllopodia. These buds often develop into accessory rhizome branches. When the older parts of the rhizome die off, these branches become separate and constitute an important method of asexual propagation.

RHIZOME STELE STRUCTURE

The rhizome consists chiefly of parenchymatous ground-tissue in which the rather small vascular strands are situated.

The stele is a dorsiventral dictostele. The dorsally very wide leaf-gaps are overlapping. The ventral part consists of an often broad, entire, shallow, channel-shaped strand. Root-traces arise irregularly from all over this strand.

Bell (1950 and 1955) recognised four forms of stelar symmetry. The South African taxa can be grouped into two of these. The first, which is the most simple and also the most common, is the dorsiventral two-ranked condition where bud-traces occur on the posterior side of each leaf-trace. The dorsal part usually consists of one or two cylindrical or irregularly shaped strands. Leaf-traces originate from the lateral sides of these strands (Fig. 2A-G).



Rhizome anatomy. A-G, *E. angustatum*, Roux 773 (NBG); 1 Schematic habit of rhizome: A-G, cross-sections as indicated in 1. H-J, cross-sections of rhizomes. H, *E. aubertii*, Roux 381 (NBG); I, *E. conforme*, Roux 774 (NBG); J, *E. acrostichoides*, Roux 780 (NBG). bd: bud-trace; rt: root-trace.

The three- or multi-ranked condition where bud-traces are associated only with the marginal leaf-traces is less frequent and of the relevant taxa occurs only in *E. aubertii* and *E. hybridum*.

In this condition the leaf-traces originate from the lateral sides of both the ventral and dorsal strands. (Fig. 2H-J). Bud-traces are only associated with the ventral rows of leaves.

AEROPHORES

Aerophores form part of the phyllopodia and are present on both sides of the phyllopodia (Fig. 1). Bell (1955) reported that these organs consist of loose parenchymatous tissue with large air-spaces and that stomata are present in the epidermis.

Aerophores show some form of variation. In *E. acrostichoides*, *E. angustatum*, *E. macropodium* and *E. conforme* the aerophores are small, oblong projecting organs, whereas those of *E. aubertii* and *E. hybridum* form a narrow linear wing which often extends beyond the point of articulation and may become confluent with the margins of the lamina. Aerophores were not observed in *E. drakensbergense* and *E. spathulatum*.

STIPE

The stipes of all the relevant *Elaphoglossum* species are articulated to phyllopodia which are part of the rhizome. Sporophyll stipes are always much longer than those of trophophylls. The stipes are firm; species such as *E. conforme*, *E. angustatum*, *E. acrostichoides*, *E. drakensbergense* and *E. spathulatum* have terete stipes whereas those of *E. aubertii* and *E. macropodium* are shallowly sulcate on the ventral surface. Towards the base of the lamina the stipe is always pale in colour, but deepens in shade towards the point of articulation.

The frequency of scales on the stipe can be extremely variable. Persistent scales are found in species such as *E. drakensbergense*, *E. spathulatum* and *E. hybridum*, whereas the scales in the other species are deciduous and generally more confined to the stipe bases.

STIPE ARTICULATION

Stipe articulation is a feature which is not more frequent in regions with seasonal climates as was stated by Wagner and Wagner (1977). Holttum (1968) pointed out that articulation is also a common feature in the wet tropics where a seasonal climate is non-existent. Articulation in this region is commonly associated with the epiphytic habit.

The sporophylls of species such as *E. conforme*, *E. angustatum*, *E. macropodium* and *E. acrostichoides* are short lived and tend to turn yellow soon after sporulation and then fall away. In *E. aubertii*, *E. hybridum*, *E. spathulatum* and *E. drakensbergense* the sporophylls are persistent for a long time after they have sporulated and died.

Trophophylls as a rule have a much longer lifespan than the sporophylls and tend to fall away only through climatological and/or physiological influences.

FROND ARCHITECTURE AND ORIENTATION

The characteristic simple and dimorphic frond pattern is found throughout the genus *Elaphoglossum*.

The trophophyll lamina of the relevant taxa varies from linear to elliptic, but in *E. spathulatum* the form varies from spatulate to ovate. The apex is

usually cuneate or obtuse while the base varies from cuneate to longly decurrent.

The coriaceous trophophyll lamina of *E. macropodium* reaches a length of up to 320 mm and a width of up to 70 mm while the trophophyll lamina of *E. spathulatum* reaches a mere length of 23 mm and a width of 12 mm.

The form of the sporophyll lamina varies from linear to rotund.

The sporophyll lamina of *E. macropodium* often reaches a length of 270 mm and a width of 40 mm while that of *E. spathulatum* reaches a length of 11 mm and a width of 10 mm.

Frond dimorphism is a character which embraces the whole frond in *Elaphoglossum*. The term, as used here, will be confined to the differentiation into spore-producing fronds or sporophylls, and sterile fronds or trophophylls.

It is widely believed that dimorphy appeared through evolutionary transitions, as fronds often do not continue to function in a double-duty state, but change from the primitive monomorphic ancestors. Theoretically, the necessity to carry out both duties, namely photosynthesis and spore production, may be eliminated if sporophylls evolve. This will permit the trophophyll and the sporophyll to become more efficient in their respective roles. Functions such as photosynthesis, spore production and spore dispersal were considered of prime importance by Wagner and Wagner (1977). They also observed that substantial differences often occur in the specialisation of the sporophyll and trophophyll. Special reference is made to various polypodioid genera where, as the sporophyll becomes longer and narrower, the trophophyll becomes shorter and wider.

They (Wagner & Wagner, l.c.), later stated that in *Elaphoglossum* the trend described above is regularly reversed as, "the trophophylls become linear, extremely long, narrow and pendent, while the sporophylls retain lanceolate outlines". It is not known on what evidence this statement is based, but it should be regarded as hypothetical due to the uncertain affinity and evolutionary trends in *Elaphoglossum*.

It is noted that the stipes of sporophylls of all the relevant species are much longer and usually also thicker than those of the trophophylls. Sporophyll laminae again are usually much smaller than those of the trophophylls except in *E. conforme* where the sporophyll is nearly as wide as the trophophyll (hence the name *conforme*). The result is that the sporophylls regularly overtop the trophophylls. This trend is the most common and should also serve more efficiently for spore dispersal by wind.

In a number of species, e.g. *E. acrostichoides*, *E. angustatum*, *E. conforme*, *E. drakensbergense*, *E. macropodium* and *E. spathulatum*, the sporophylls grow upright while the trophophylls are spreading. Theoretically this trend would prove more efficient photosynthetically. The size of the lamina

surface between sporophyll and trophophyll is also not very extensive. Although these taxa are found in forested areas they tend to be widespread and adaptable to more variable conditions. *E. aubertii* and *E. hybridum*, which are exclusively forest dwellers of the temperate regions, have sporophylls and trophophylls which grow erect. The lamina surfaces of the sporophylls in these species are much smaller than those of the trophophylls.

VENATION

Free venation is the condition most common in *Elaphoglossum*; reticulate venation, however, is not uncommon (Fig. 3).

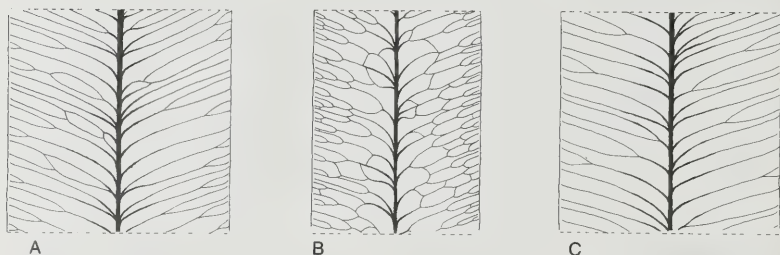


FIG. 3.

Schematic illustration of venation types. A and B, *E. hybridum*, A. trophophyll, B. sporophyll; C, *E. angustatum*, trophophyll.

Bower (1923), pointed out that some acrostichoid ferns have no special vascular provision for the nutrition of the sporangia. This does not apply to the relevant species as in all, except occasionally in *E. conforme*, the sporophylls have a more complex venation pattern than the trophophyll. Not only are the veins more closely spaced but the dichotomies are also more frequent (Table 1). Reticulate venation occurs in the sporophyll of *E. hybridum*. Although more sporadic, it also occurs in the trophophylls of this species as well as in those of *E. aubertii* and *E. macropodium*. The sporophylls of the latter species have a more complex free venation pattern.

E. aubertii is the only South African species of *Elaphoglossum* in which each vein in the trophophyll ends in a hydathode near the margin, a character which is absent in the sporophyll. The function of this organ is not fully understood but it may be of significance with regard to evolutionary changes which probably may have occurred in the sporophyll.

TABLE 1.
Comparative studies in the sporophyll-trophophyll venation of *Elaphoglossum*

	Sporophyll		Trophophyll	
	Midrib	Margin	Midrib	Margin
<i>E. acrostichoides</i>	6-7	16-23	4-6	12
<i>E. angustatum</i>	4	13-14	3-4	6-8
<i>E. aubertii</i>	4-6	11-12	2-3	3-4
<i>E. conforme</i>	6-9	12-20	7-9	9-20
<i>E. drakensbergense</i>	7-9	17-19	4-6	14-16
<i>E. hybridum</i>	4-6	12-14	2-3	6-8
<i>E. macropodium</i>	4-5	8-10	3-5	8-10
<i>E. spathulatum</i> *	5	10	5	10

Counts were made within 10 mm along the midrib and again within 10 mm along the margin of the same frond. Sporophyll-trophophyll counts were made from the same plant.

* As the sporophyll of this species seldom reaches a length of 10 mm the figure given is that of the entire frond.

SCALES

In all species scales are found on the rhizome, stipe, midrib and lamina. These scales are variable in character depending on location and provide an important means of species discrimination.

The rhizome scales of all species, with the exception of *E. hybridum*, are scariose or with a few sclerified cells at the point of affixation. The scales of *E. hybridum* are sclerified throughout.

Rhizome scales vary in form from lanceolate to ovate. In *E. conforme* the scales are entire or crenulate whereas those of *E. drakensbergense* are shallowly dentate. The scales of all the other relevant taxa have few short or long filiform to cuneate filamentous marginal outgrowths. This character is more prominent in *E. acrostichoides* and *E. angustatum* where such outgrowths are numerous.

Stipe scales are usually scariose and deciduous. The stipe scales of *E. conforme*, *E. drakensbergense*, *E. hybridum* and *E. spathulatum* show no change in form from those on the rhizome. The general tendency of stipe scales is to become simplified. In *E. acrostichoides* the long filiform marginal outgrowths become a shallowly dentate margin and in *E. macropodium* the size of the outgrowths is reduced but become more frequent. In *E. aubertii* the scales become entire whereas those of *E. angustatum* become somewhat amorphous, as stellate scales are frequently found among rhizome-like scales.

Scales which are often very similar to those on the rhizome regularly extend to the lamina midrib. These scales are even more simplified than the stipe scales. In *E. angustatum* the scales become filiform to substellate.

The presence of scales along the midrib varies from sporophyll to trophophyll and from the ventral surface to the dorsal surface. In *E. macropodium*, *E. hybridum* and *E. angustatum* simple scales occur on both the ventral and dorsal surfaces of the sporophyll midrib. Simple scales however are confined to the dorsal surfaces of *E. conforme* and *E. acrostichoides*. The midrib on the ventral surfaces of these two species is glabrous.

In *E. macropodium*, *E. hybridum*, *E. conforme* and *E. acrostichoides* simple scales occur on the midrib of both ventral and dorsal surfaces of the trophophyll. Similar scales are confined to the dorsal surface of *E. angustatum*. The ventral surface of this species is glabrous.

Scales also occur on the lamina surfaces of *E. drakensbergense*, *E. spathulatum* and *E. aubertii*, but it is only on the dorsal surfaces of the trophophyll in *E. drakensbergense* that the scales are confined to the midrib.

On the dorsal surface of the *E. conforme* trophophyll there are numerous minute rotund to stellate scales which are often quite densely beset with firm, short or long, black spines which could be glandular hairs. Although these scales are more confined to the lamina base they may extend to the apex. During the early stages of their development they exude a resinous substance which makes the juvenile fronds sticky to the touch.

Conspicuous glands, similar to those which occur on the dorsal surface of the trophophyll of *E. drakensbergense*, remain once the scales have been removed.

Some form of dimorphism between sporophyll and trophophyll scales can be identified. A scaleless condition on both surfaces of the sporophyll occurs in *E. hybridum* and *E. aubertii*. In *E. aubertii* scales are abundant on both surfaces of the trophophyll but less frequent on the trophophyll lamina of *E. hybridum*.

In the sporophyll the ventral or upper surface of *E. drakensbergense* and *E. spathulatum* is densely paleate. No differentiation exists between the trophophyll and sporophyll scales in *E. drakensbergense*, but the sporophyll scales of *E. spathulatum* are generally enlarged. The dorsal or lower surfaces of the sporophylls in both these species are scaleless.

Lamina scales of *E. acrostichoides*, *E. conforme* and *E. macropodium* are highly simplified. On the ventral surfaces of the trophophyll these scales are infrequent and more often confined to the lamina bases. Scales similar in character are more frequently found on the dorsal surfaces. In *E. angustatum* simplified scales are more frequently found on the ventral and dorsal surfaces of the trophophyll.

With the exception of the dorsal surfaces of *E. drakensbergense*, both

ventral and dorsal surfaces of the trophophyll in *E. drakensbergense* and *E. spathulatum* are densely paleate. The trophophyll dorsal surface of *E. drakensbergense* has scales which are restricted to the midrib. These scales are slightly smaller than those along the midrib of the sporophyll.

The sporophyll scales, which are confined to the ventral surfaces of the lamina, are enlarged from the trophophyll scales in *E. acrostichoides* and *E. conforme* while those of *E. macropodium* remain unchanged from the trophophyll. The sporophyll scales of *E. angustatum*, which are more confined to the lamina base and midrib, are undifferentiated from those of the trophophyll.

Where differences in scales occur within a species it is noted that the trophophyll condition is usually simplified; for example rotund, subentire or shallowly serrulate and scariose.

Scale density on the trophophyll and sporophyll as an indication of evolutionary advancement remains a controversial subject.

SPORANGIUM

One of the characteristic features of *Elaphoglossum* is the acrostichoid sori. Sporangia with stalks of variable length are densely crowded on the dorsal surface of the sporophyll. Ripening of the sporangia is irregular.

The interrupted row of large annulus cells is relatively prominent with the exception of *E. hybridum* which has rather small annulus cells. The number of cells is most variable in *E. acrostichoides*. In this species it varies between 8 and 14. The most general figure recorded in the relevant taxa is 12 cells per sporangium.

SPORES

Spores, when studied with the electron microscope, show considerable variation. The spore wall in most species has slender or short crests but in *E. drakensbergense* and *E. spathulatum* the spore wall forms low undulating ridges. The monolet structure of the spore is also most prominent in these taxa (Fig. 5C-F).

The surfaces are usually densely ornamented with short distinctive spinules, but in some species this is absent. In species such as *E. acrostichoides* the crests are perforated (Fig. 4C-D).

Mickel and Atehortúa (1980) studied spores of a considerable number of taxa and they noted that the spore morphology proved to be quite useful in confirming presumed relationships within their system of generic breakdown.

JUVENILE FRONDS

The juvenile fronds of all the species studied are morphologically remarkably similar to the mature fronds. The frond architecture remains sim-

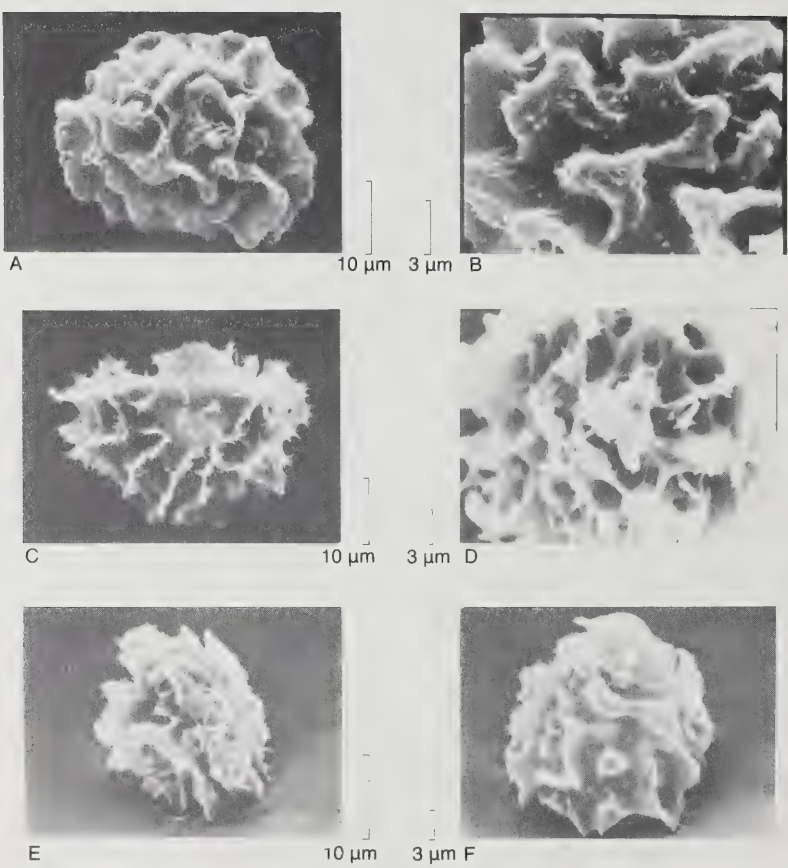


FIG. 4.

Spores of *E. conforme*, *E. acrostichoides* and *E. macropodium*. A and B, *E. conforme*, Roux 775 (NBG), C and D, *E. acrostichoides*, C, Roux 306, D, v. d. Zeyde s.n. (NBG); E and F, *E. macropodium*, Roux 382 (NBG).

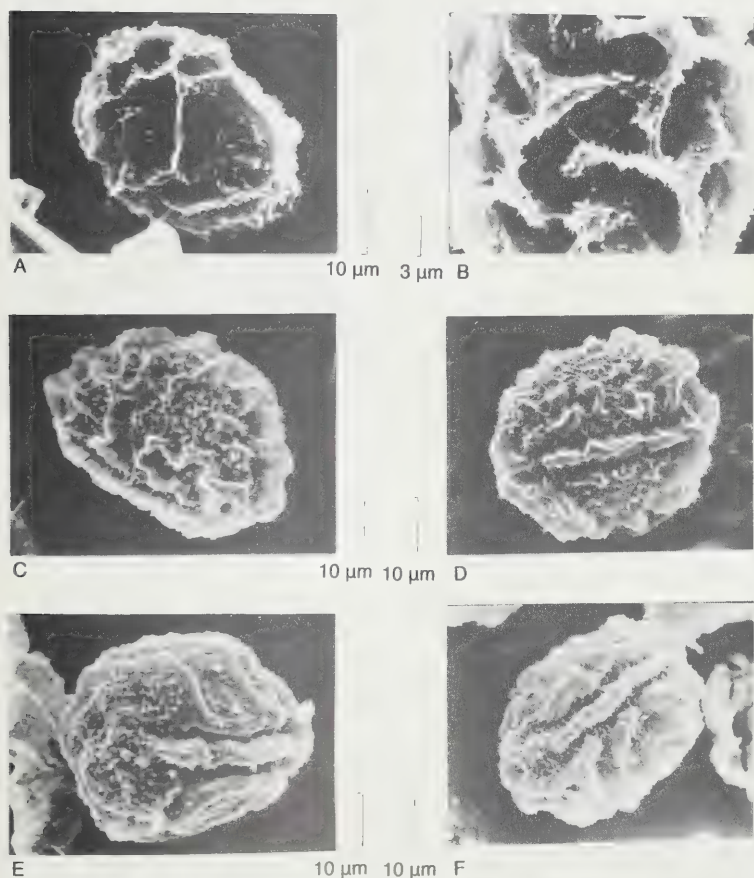


FIG. 5.

Spores of *E. angustatum*, *E. spathulatum* and *E. drakensbergense*. A and B, *E. angustatum*, Roux 773 (NBG); C and D, *E. spathulatum*, Roux 970 (NBG); E and F, *E. drakensbergense*, Roux 824 (NBG).

ple and the scales show no significant variations from that of the mature state. Also the venation remains free (Fig. 6).

Of special interest is the persistence of the juvenile fronds during the first stages of development. Articulation can therefore be considered as representing a derived condition. This however needs further investigation.

JUVENILE FRONDS AND PHYLOGENY

There are two fundamental plans of frond organisation; dichotomous and monopodial. The dichotomous form, critically analysed by Wagner (1952) does not occur in the genus *Elaphoglossum*.

As the juvenile plants are morphologically remarkably similar to the mature plants they are of interest as theoretically, the phylogeny should be based on evidence obtained from all ontogenetic developmental stages of the life-cycle. It can therefore be assumed that in *Elaphoglossum* the tendency of diversification, or simplification, as is generally believed to take place in some fern groups, has been partially lost. This appears to be a typical example of neotony as the simple phenotype, with its complex genotype, maintained its evolutionary plasticity.

SYSTEMATICS

Elaphoglossum Schott ex J. Smith in Hook. Journ. Bot. 4: 148 (1841) nom. cons. Type: *E. conforme* (Sw.) J. Smith in Hook. Journ. Bot. 4: 148 (1841). Habitat in Insula St. Helenae, *Masson s.n.* (UPS-THUNB, holo.!).

Epiphytic, lithophytic or terrestrial, of moderate size or small; rhizome dorsiventral, short or long, creeping, branched, paleate; stipe approximate or caespitose, articulated to enlarged phyllopodia which arise from the rhizomes; fronds dimorphic, stipes of sporophylls usually longer than that of trophophyll; lamina simple, entire, firmly herbaceous to coriaceous, moderately to densely paleate; sporophyll much smaller and narrower than trophophyll except in *E. conforme*; veins evident or immersed, dichotomously branched, parallel, free or reticulate; sori acrostichoid, sporangia sphaeroidal to somewhat compressed, annulus cells 8–14, usually 12; spores monolete, rotund to ellipsoid, brownish to black.

KEY TO THE SOUTH AFRICAN SPECIES OF *ELAPHOGLOSSUM*

- 1a Trophophyll lamina glabrous or with numerous minute, appressed, peltate, subrotund to stellate scales.
 - 2a Rhizome scales scariose, entire to crenulate; scales on dorsal surface of trophophyll lamina rotund to stellate, glandular 1. ***E. conforme***
 - 2b Rhizome scales scariose or sclerified, with few or numerous filamentous outgrowths, lamina not glandular.
 - 3a Trophophyll lamina linear to narrow-lanceolate; up to 240 × 27 mm at maturity 2. ***E. acrostichoides***

- 3b Trophophyll lamina oblong to elliptic; up to 320 × 70 mm at maturity.
- 4a Trophophyll coriaceous; narrow to broad-elliptic; stipe scales ovate, more or less confined to the base, scales with short filamentous outgrowths along margin 3. *E. macropodium*
- 4b Trophophyll herbaceous; linear to narrow-elliptic; stipe scales amorphous, not confined to the lamina base 4. *E. angustatum*
- 1b Trophophyll lamina densely scaled or with prominent scales at least along the midrib and margin.
- 5a Trophophyll less than 100 mm long at maturity; sporophylls ventrally densely scaled.
- 6a Dorsal surface of trophophyll scaled 5. *E. spatulatum*
- 6b Dorsal surface of trophophyll with scales confined to the midrib 6. *E. drakensbergense*
- 5b Trophophyll more than 100 mm long at maturity; sporophylls ventrally scaleless.
- 7a Trophophyll lamina scaled ventrally and dorsally; trophophyll veins end in hydathodes near margin 7. *E. aubertii*
- 7b Trophophyll lamina scales mainly confined to the midrib and margin; trophophyll veins not ending in hydathodes 8. *E. hybridum*

1. *Elaphoglossum conforme* (Sw.) J. Smith in Hook. Journ. Bot. 4: 148 (1841).

Acrostichum conforme Sw., Syn. Fil.: 10, 192, t.1, f.1 (1806). Type: Habitat in Insula St. Helenae, *Masson s.n.* (UPS-THUNB no. 24405, holo!). **Figs 7 and 8A–D.**

Olfersia conformis (Sw.) C. Presl, Tent. Pterid.: 235 (1836).

Acrostichum oblongum Desv. in Mag. Ges. Naturf. Berl. 5: 308 (1811). Type: Habitat in C. bonae Spei, in Herb. Desvaux (P, holo!).

Acrostichum glandulosum Carm. ex Hook. & Grev., Ic. Fil.: t.3 (1830). Type: Cape of Good Hope, *Carmichael s.n.* (K, holo!).

Acrostichum conforme Sw. var. *glandulosum* (Carm.) Fée, Mém. Fam. Foug. 2: 34 (1845).

Acrostichum viscosum Sw. var. *rupestre* Sim. Ferns S. Afr., ed. 1: 222, t.82, f.2 (1892) pro parte. Type: Table Mountain, *Bolus 3899* (BOL, lecto.).

Elaphoglossum petiolatum (Sw.) Urban var. *rupestre* (Sim) Sim, Ferns S. Afr., ed. 2: 288, t.150, f.2 (1915).

Rhizome creeping, branched, up to 5 mm diam., verruculate, glutinose, phyllopodia 5–11 mm long, black, aerophores small, rhizome densely set with pale brown, scarioso, lanceolate, crenulate to entire scales, up to 5 × 1.5 mm; stipe approximate, firm, trophophyll stipe up to 160 mm long, sporophyll stipe usually longer than that of trophophyll, up to 270 mm long, with pale brown, scarioso lanceolate to cuneate, entire to crenulate scales more frequent at base, up to 7 × 2 mm; trophophyll simple, entire, coriaceous, oblong to elliptic, base acute to longly decurrent, up to 170 × 40 mm, venation free, midrib shallowly sulcate ventrally, ventral surface with pale

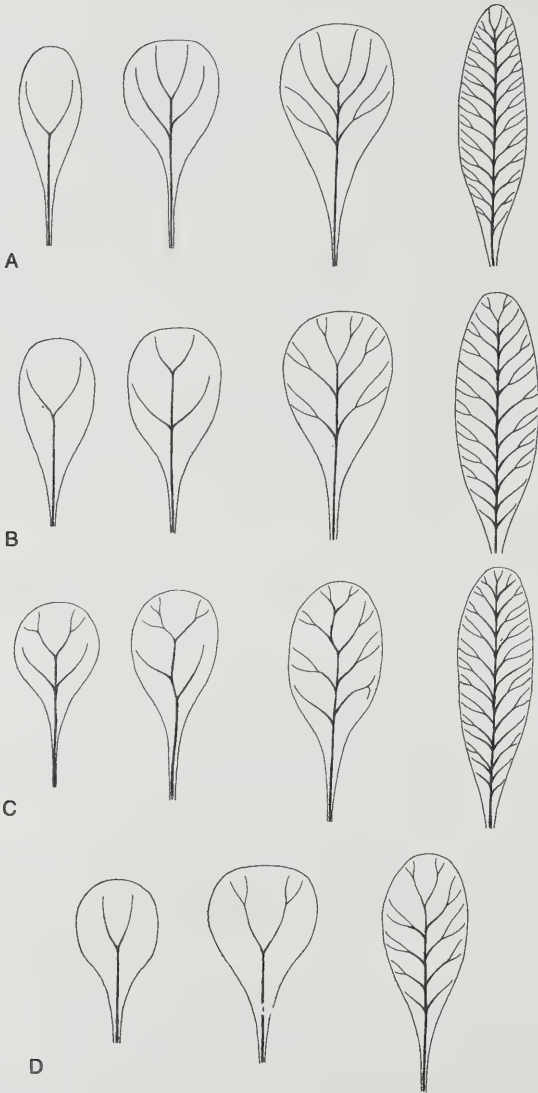


FIG. 6.

Series of juvenile fronds. A, *E. acrostichoides*, Roux 780 (NBG); B, *E. conforme*, Roux 774 (NBG); C, *E. angustatum*, Roux 773 (NBG); D, *E. spathulatum*, Roux 885 (NBG).



FIG. 7.
E. conforme, habit. Roux 775 (NBG).

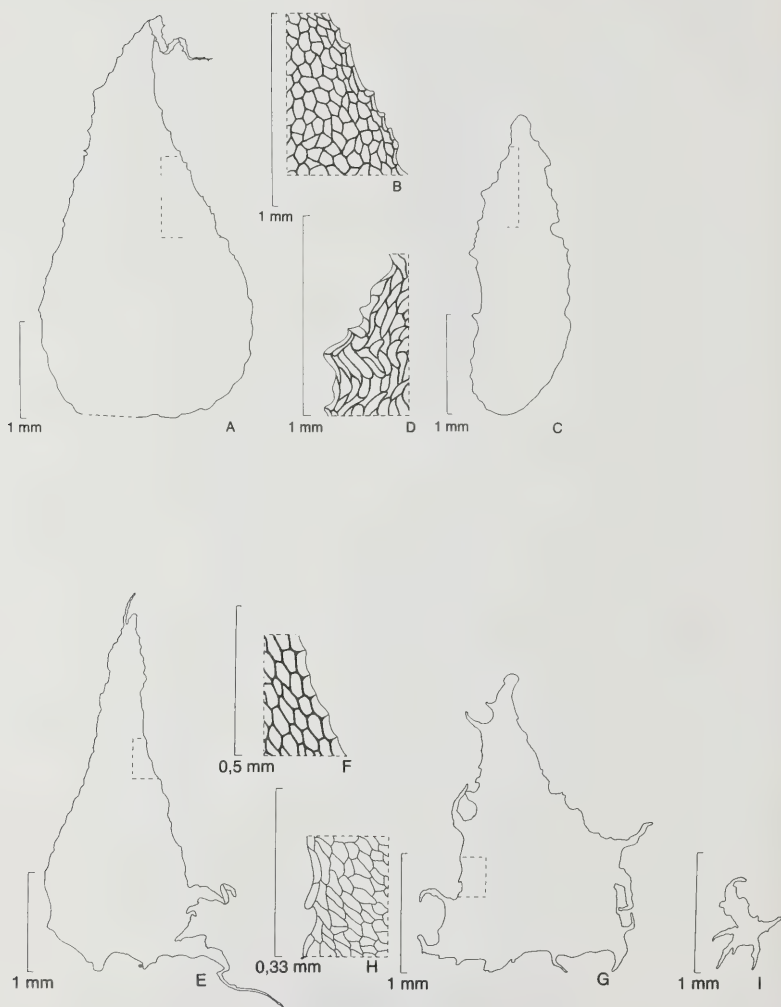


FIG. 8.

Scales of *E. conforme*, Roux 775 (NBG) and *E. acrostichoides*, v. d. Zeyde s.n. (NBG). A-D, *E. conforme*. A. rhizome scale; B. detail; C. trophophyll scale from dorsal surface, midrib; D. detail. E-I, *E. acrostichoides*. E. rhizome scale; F. detail; G. trophophyll scale from dorsal surface; H. detail; I. trophophyll scale from ventral surface.

Fern genus Elaphoglossum Schott (Filicales) in S.A.

brown, scariose, ovate, entire to shallowly crenulate scales, up to 4.5×1 mm, confined to lamina base and midrib, minute, rotund, peltate scales frequent on lamina, dorsal surface with scariose, lanceolate to ovate scales confined to midrib, minute rotund to stellate spinose resin-exuding scales more frequent on lamina; sporophyll simple, entire, coriaceous, oblong to elliptic, up to 135×27 mm, venation free, ventral surface with pale brown, ovate scales with numerous filamentous outgrowths along margin, frequent along midrib, minute sclerified, substellate to stellate, peltate scales frequent on lamina, not absent on dorsal surface; sori acrostichoid, annulus large, 11–13 (12)-celled; sporoderm undulate, reticulate, ridges up to $5 \mu\text{m}$ high, crest more or less smooth, areas between papillate, 39–42 μm diam.

Elaphoglossum conforme is represented in the Swartz herbarium by a rhizome fragment only. This sheet originally formed part of the Cassstrom collection. Neither collector nor locality are provided. The possibility that it formed part of the original Masson collection should not be overlooked.

The material which is at present accepted as the type of Desvaux's *Acrostichum oblongum* consists of a mixed collection. The largest portion of the material—the specimen in the centre and bottom right—fits Desvaux's description very well. This is *E. conforme*. The specimen on the left of the sheet appears to form part of the collection on a second sheet. Desvaux also named this *A. oblongum*. It is, however, *E. angustatum* (Schrad.) Hieron.

The material on which Carmichael based his *Acrostichum glandulosum* is a typical xeromorphic form. The plants are depauperate and excessively glandular.

Sim's treatment of *Elaphoglossum* (1892: 1915), should be disregarded in all respects. His *A. viscosum* var. *rupestre* (1892), which he later called *E. petiolatum* var. *rupestre* (1915), should obviously be *E. conforme* (Sw.) J. Smith.

PHYTOGEOGRAPHY AND ECOLOGY

Elaphoglossum conforme appears to be restricted to the Table Mountain range on the Cape Peninsula and the immediate surrounding mountains in the South-western Cape. The geology of the area consists entirely of Table Mountain Sandstone (Fig. 10).

At Woodhead, on Table Mountain (alt. 747 m), where this species is relatively common, the precipitation measures 1 623 mm per annum. Mists are frequent throughout the year but more so at altitudes above 600 m.

The distribution of *E. conforme* is more or less restricted to altitudes above 500 m. Habitats vary from wet conditions in deeply shaded ravines to small caves and rock overhangs. At higher altitudes where the plants are more frequently found they tend to be confined to seasonally dry rock cre-

ices on low cliffs. In conditions such as these, exposure and severe climatic conditions such as high winds and dry summer months (November–February) cause the plants to be extremely depauperate.

Hemicyptophyte (lithophytic). Meso- xerophilous, fronds xeromorphic, articulated. Seasonal pattern irregular. Effective vegetative propagation by branched, creeping rhizome. Sporelings are rarely found in moist rock crevices or on permanently moist rock faces.

PHENOTYPE VARIATION

The most significant degree of variation observed in *E. conforme* was in frond size. This is largely due to the habitat of the plant. Plants growing in moist protected situations may have fronds up to 370 mm long whereas plants in exposed xeric conditions may have fronds that are merely 70 mm long.

The South African phenotype varies in numerous ways from the type collection. The cell-walls of the rhizome scales in the type material are more or less straight, whereas in the South African material the cell-walls are much twisted. No scales extend to the lamina midrib nor are any scales present on the lamina surfaces. In the type material the lamina is also very sparsely glandular. Xeromorphs appear to be more glandular.

MATERIAL EXAMINED

CAPE—3318 (Cape Town): Table Mountain, Cape Peninsula (-CD), 13/11/1963, *Esterhuysen 30541* (BM, C, NBG); Table Mountain, below reservoirs, -/11/1919, *Michell s.n.* (NBG); Corrells Ledge, Table Mountain, 23/2/1941, *Bond 963* (NBG); Top of Table Mountain, above Kirstenbosch, 13/10/1976, *Roux 93* (NBG); Woodhead Saddle, Table Mountain, 28/11/1897, *Froembling 394* (NBG); Between Table Mountain and Devils Peak, 24/1/1946, *Schelte 1181* (NU); Table Mountain, -/2/1887, *Thode 27436* (STE); Table Mountain, Disa Gorge, 10/11/1963, *Esterhuysen 30540* (BM, C); Table Mountain, Grotto Ravine, 8/9/1963, *Esterhuysen 30332* (BM); Table Mountain, Grootkop area, 18/7/1963, *Esterhuysen 30268* (BM, C); Table Mountain, *Harvey s.n.* (BM); Devils Peak, 9/9/1883, *Wilms 3906A* (BM, G); Tafelberg Plateau, 27/7/1883, *Wilms 3906* (BM, K); Table Mountain, *sine coll.* (K); Spitze des Devilspeak, 9/9/1883, *Wilms s.n.* (G, K); Kloof beyond Kirstenbosch, 26/9/1896, *Wolley-Dod s.n.* (K); Tafelberg, 20/9/1958, *Werdermann & Oberdieck 34* (K). —3319 (Worcester): Dutoitskloof (? et Genadenthal) (-CA-CC), *Drège s.n.* (B). —3418 (Simonstown): Southern aspect, Constantiaberg, Cape Peninsula (-AB), 8/3/1940, *Bond 188* (NBG). Without exact locality: C.B.S., Ex Herb. Hooker, -/-/1867 (K); Cap, -/8/1845, *Drège s.n.* (G); C.B.S., *Wilce s.n.* (C); Pr. b. Sp., *Gueinzus s.n.* a-d (S); Cap b. Sp., *Warwa 50*—except central bottom specimen (W); Cap b. Sp., *Bojer s.n.* (W); Cap, *Scholl s.n.* (W); *Barkley 138* (GRA).

2. *Elaphoglossum acrostichoides* (Hook. & Grev.) Schelte in Jl S. Afr. Bot. 30(4): 196 (1964). Figs 8E–I and 9.

Vittaria acrostichoides Hook. & Grev., Ic. Fil.: t.186 (1830). Type: Cape of Good Hope, *Carmichael s.n.* in Herb. Hooker (K, holo.!).



FIG. 9.
E. acrostichoides, habit. v. d. Zeyde s.n. (NBG).

Drymoglossum acrostichoides (Hook. & Grev.) Moore, Ind. Fil.: 31 (1857).

Acrostichum lineatum Kuhn ex Christ, Monogr. Elaph.: 146 (1889) non Cav. (1799). Type: Madagascar, S. Betsileo, Ankafina, *Hildebrandt* 4179 (B, holo.!).

Elaphoglossum conforme (Sw.) Schott var. *lineatum* (Kuhn ex Christ) C. Chr. in Perrier, Cat. Pl. Madag.: 61 (1932).

Elaphoglossum preussii Hieron. in Bot. Jahrb. 46: 402 (1911). Type: Buea, Wald 1/2 Std. westlich von den Höhlen westlich von Buea, *Preuss* 937 (B, holo.!; P, iso.!).

Acrostichum conforme (Sw.) Schott var. *angustata* Kunze in Linnaea 10: 495 (1836) reimpr. as Pl. Acot.: 15 (1836). Type: Promont. bon. Spei, in cacumine, *Bergius s.n.* (B, lecto.!); *Burchell* Catalogus Geographicus Plantarum Africae Australis Extratropicae no. 479. in Herb. De Candolle (G, syn.!).

Rhizome creeping, branched, up to 3,5 mm diam., phyllopodia 2–7 mm long, black, aerophores large, rhizome densely set with lanceolate scales which are entire or have a few filamentous outgrowths at the sclerified base, up to 5×2 mm; stipe approximate, terete, firm, pale green, trophophyll stipe up to 180 mm long, sporophyll stipe usually longer than that of trophophyll, up to 190 mm long, with few deciduous, scariose, ovate scales with few filamentous outgrowths along margin, up to $2,5 \times 1,5$ mm; trophophyll simple, entire, firmly herbaceous, linear, longly decurrent to base and apex, midrib shallowly sulcate ventrally, up to 243×27 mm, venation free, ventral surface glandular, with few deciduous, scariose scales similar to those on stipe along midrib, minute, frequent pale rotund scales on lamina, dorsal surface glandular, with few deciduous, scariose scales along midrib and numerous minute, pale brown, scariose, stellate scales on lamina; sporophyll simple, entire, firmly herbaceous, linear, base longly decurrent to cuneate, midrib shallowly sulcate ventrally, up to 175×15 mm, venation free, ventral surface glandular, with numerous minute, pale brown, scariose, stellate scales, dorsal surface glabrous; sori acrostichoid, often incomplete at base, annulus large, 8–14 (12)-celled, sporoderm deeply and irregularly undulate, forming short reticulate ridges with pores at base, crest spinulose, areas between scabrous, 40–45 μ m diam.

The identity of *Vittaria acrostichoides* Hook. & Grev. remained a mystery for more than 130 years. Fée was doubtful about the identity of this species as in his *Histoire des Vittarées et des Pleurogrammées* (1851–1852) he remarked that it could belong to the genus *Pteropsis*.

Moore (1857), also uncertain about the identity, placed the species in the genus *Drymoglossum*. By 1868, Hooker and Baker realised that this plant

was not a *Vittaria* but an "*Acrostichum*". Under *A. conforme* they remarked that "*Vittaria acrostichoides* Hook. & Grev. is an abnormal form, with the fruit in two submarginal lines".

Sim's treatment of *Elaphoglossum* (as *Acrostichum*) in the first edition of his *Ferns of South Africa* (1892) led to further confusion. He wrongly identified specimens of *E. acrostichoides* with the tropical American *Acrostichum viscosum* Sw. (a later name for *A. petiolatum* Sw.). In the *Index Filicum* (1905) Christensen followed Christ in recognising the genus *Elaphoglossum*, but copied the error of Hooker & Baker in recording *Vittaria acrostichoides* as a synonym of *E. conforme*. In Sim's second edition (1915), he adjusted his generic names to those of Christensen, but in dealing with *E. acrostichoides* he merely altered *Acrostichum viscosum* to *Elaphoglossum petiolatum*.

When preparing the *Flora of the Cape Peninsula*, Adamson (1942) made an attempt to clarify this problem but failed. His *E. conforme* is, in fact, *E. acrostichoides*.

It was only in 1964 that *Vittaria acrostichoides* was referred to as an *Elaphoglossum* by Schelpe.

PHYTOGEOGRAPHY AND ECOLOGY

E. acrostichoides is the most widespread of the South African species of *Elaphoglossum*. The species occurs through a wide range of geological formations but is strictly confined to the higher rainfall zones. In the Cape, it is probably confined to the parts south and east of the major mountain ranges while in Natal, the Orange Free State and Transvaal the species is more commonly found along the Drakensberg escarpment and the immediate surrounding areas (Fig. 10).

In the Cape, Transvaal and the lower lying southern parts of Natal, the species is more or less restricted to Table Mountain Sandstone. Higher up, in the Natal midlands and the eastern Free State, the species is more confined to Cave Sandstone.

Precipitation varies from 906 mm at Tzaneen to 1 341 mm per annum at Nkandhla. Mists are frequent throughout the year in the mountainous parts. At Harrismith and Kokstad the species occurs within the snowline. Snowfalls however are irregular.

Due to the extensive distribution range of *E. acrostichoides*, the habitat also varies considerably. Plants have been recorded from deeply shaded, wet mist forests to xeric conditions along the Drakensberg escarpment.

Hemicryptophyte (geophytic, lithophytic or epiphytic). Mesophilous, fronds meso- xeromorphic, poikilohydrous, articulated. Seasonal pattern regular. Effective vegetative propagation by branched, creeping rhizome. Sporelings are commonly found in moist situations.

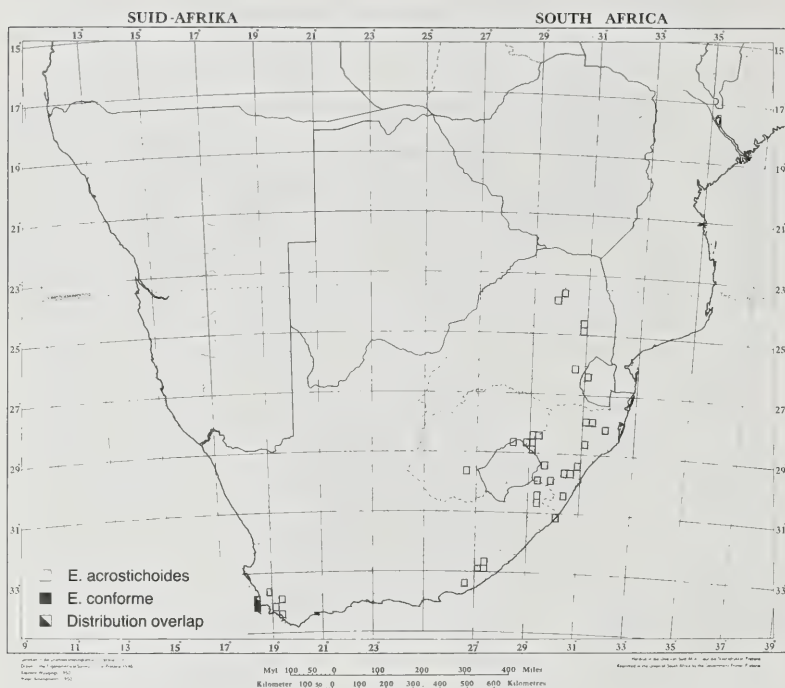


FIG. 10.
Distribution map of *E. conforme* and *E. acrostichoides*.

The plants appear to be largely influenced by climate. Fertile fronds are commonly found towards the end of the summer within the same climatological region. When looking at the distribution as a whole, there would appear to be no detectable distribution pattern.

PHENOTYPE VARIATION

Variation is most extensive in frond size. This is largely due to the topography and the wide range of climatological influences which are experienced within the geological distribution.

Depauperate forms are frequent in exposed and xeric conditions. Such plants usually have entirely sclerified, subentire rhizome scales.

MATERIAL EXAMINED

TRANSVAAL—2329 (Pietersburg): Houtbosch (-DD), *Rehmann* 3593 (K).

—2330 (Tzaneen): Westfalia Estate near Duivelskloof (-CA), 10/3/1977, *van Jaarsveld* 1902 (NBG); Woodbush, *Eastwood* 157 (GRA).

—2430 (Pilgrims Rest): Mariepskop, near summit (-DB), *Schweickerdt* 2439 (NU); Mariepskop plateau, 24/1/1968, *Strey* 7910 (NH); Mariepskop, near waterfall, 6/12/1961, v. d. Schyff 5902 (K); On top of Mariepskop, 5/1/1960, v. d. Schyff 4825 (W); Klaserie waterfall, Mariepskop, 6/1/1960, v. d. Schyff 4928 (W); Kovyns Pass (-DD), 12/6/1946, *Schelpel* 1 648 (NU); In cinvallibus-Drakensbergen—"Pilgrims Rest Gold Fields", -/6/1894, *Bolus* 1730 (SAM); Graskop, Fairyland, 6/1/1979, *Roux* 394 (NBG).

—2630 (Carolina): Near The Brook, between boulders (-BA), 2/11/1968, *Strey* 8014 (NH).

ORANGE FREE STATE—2828 (Bethlehem): Witsieshoek (-DB), -/3/1896, *Thode* 6248 (STE).

—2829 (Harrismith): Donkey's Pass, Platberg (-AC), 28/6/1980, *Roux* 799 (NBG); Farm Bosch Hoek (-AD), 5/11/1980, *Roux* 847 (NBG); Farm Bosch Hoek, eastern slopes of Manyenzeza, 5/11/1980, *Roux* 850 (NBG); In umbrosis pr. Van Reenen, 2/3/1895, *Schlechter* 6917 (GRA, SAM); Van Reenen, -/2/1908, *Thode* 4183 (STE); Klavervlei, on Seheletwane (-CA), 30/10/1980, *Roux* 828 (NBG); Klavervlei, between sandstone boulders, 30/10/1980, *Roux* 834 (NBG).

—2926 (Bloemfontein): Near Collingham (-DA), 11/9/1926, *Britten* 5417 (GRA).

SWAZILAND—2631 (Mbabane): Hill NE of Mbabane (-AC), 27/5/1958, *Comp-ton* 27849 (NBG).

NATAL—2731 (Louwsburg): Injasuti, Natal (-CC), 7/4/1950, *Johnstone* 420 (NU); Ngome Forest, Ngotshe Distr. (-CD), 10/2/1962, *Tinley* 713 (NU); Ngome forest, 26/10/1952, *Johnstone* 629 (NU); Daycott Hill (-DC), 19/4/1945, *Acocks* 11446 (NH).

—2831 (Nkandhla): Nhlwati, Hlabisa Distr. (-BB), 28/3/1954, *Ward* 2262 (NU); About 20 miles N of Qudeni Police St. (-CA), -/2/1940, *Fisher & Schweickerdt* 130 (NH).

—2828 (Bethlehem): Sunday Falls, Royal Natal National Park (-DB), 6/11/1946, *Schelpel* 1813 (NH); Gudu Forest, Mount aux Sources, 13/4/1946, *Schelpel* 1569 (NU).

—2829 (Harrismith): Little Switzerland, Oliviershoek (-CA), 16/3/1981, *Roux* 967 (NBG); nKdhanhla Forest, Cathedral Peak area (-CC), *Schelpel* 753 (NU); Indumeni Forest, Cathedral area, -/7/1944, *Schelpel* 714 (NU); nKdhanhla Forest, Cathedral area, -/7/1943, *Schelpel* r38, *Schelpel* p23 (NU); Indumeni River Valley, Cathedral Peak area, 14/2/1952, *Killick* 1673 (NU).

—2929 (Underberg): Aamberg, Game Pass (-BC), -/12/1947, *Gordon-Gray* 76 (NU); Polela River Valley, Cobham Forestry Reserve (-CD), 6/12/1978, *Cowan* 153 (NU); Upper Polela Cave, Cobham Forestry Reserve, 10/3/1979, *Cowan* 163 (NU); *Hilliard & Burt* 12554 (NU); Bulwer (-DD), 14/4/1945, *Clarkson* 185 (NU); Bulwer, -/6/1943, *Henkel* s.n. (NU).

—2930 (Pietermaritzburg): Kingcliffe, New Hanover Distr. (-BD), 5/1/1965, *Moll* 1511 (NU); Zwartkop, Pietermaritzburg (-CB), -/1/1916, *Carnegie* 752 (NU); Table Mountain, Natal (-DA), -/6/1947, *Johnstone* 125 (NU); Table Mountain, Natal, -/5/1947, *Ward* 100 (NU).

—3029 (Kokstad): Mt. Curry, East Griqualand (-AD), *Edwards* 116 (NU); Farm Westlands, Kokstad (-CB), 14/1/1979, *Roux* 430 (NBG).

—3030 (Port Shepstone): Hlokozi, Umzimbi, Alexandra Country (-AD), 17/1/1919, *Rudatis* s.n. (STE).

—3130 (Port Edwards): Isingolweni road (-AA), -/1/1951, *Huntley* 748—top left and bottom right specimens (NU).

LESOTHO—2828 (Bethlehem): Lirebe (-CB), *Dieterlen* 679 (NBG).

CAPE—3227 (Stutterheim): Evelyn Valley, Stutterheim (-CB), 13/1/1967,

Compton 19229 (NBG); Mt. Kemp, Keiskamma Hoek Distr., 26/4/1950, *Killick* 913 (NU); Evelyn Valley, Stutterheim, *Taylor* 4198 (NBG); Kingwilliamstown (-CD), -/1892, *Sim* s.n. (NU); Dohne Mountains, Kaffraria, -/1894, *Sim* s.n. (STE).
 —3318 (Cape Town): In Monte tabul., Cap b. Sp. (-CD), *Ecklon* s.n. (C); Prom. bonae Spei, in monte Tabulari, *Rehmann* 696 (W); Fernwood Gully, Table Mountain, 30/7/1977, *Roux* 175 (NBG); Disa Gorge, Table Mountain, 2/1/1977, *Roux* 96 (NBG); Table Mountain, *Rawson* s.n. (SAM); Berg River Hoek, Paarl (-DB), 4/10/1942, *Compton* 13861 (NBG); Asgaaibosch, Stellenbosch, 20/8/1947, *STE* 31226 (STE); Van Brackels Kloof, Stellenbosch, -/5/1920, *Garside* 1471 (K).
 —3319 (Worcester): Silverstreams, east of Villiersdorp (-CD), 23/11/1974, *Olivier* 5493 (STE).
 —3326 (Grahamstown): Paradise Kloof, Coldspring (-BC), 11/2/1924, *Britten* 5081 (GRA); Amos Kloof, Grahamstown, -/1864, *Holland* s.n. (SAM); In umbrosis rupestris fissuris, Grahamstown, *McOwan* 1246 (SAM).
 —3419 (Caledon): Grabouw, Lebanon Forest Reserve (-AA), 5/4/1967, *Kruger* 369 (STE); In monte Zwartberg-Caledon (-AD), -/8/-, *Ecklon & Zeyher* s.n. (SAM); Caledon, SAM 24977—specimen on left (SAM).
 Without exact locality: Himeville Distr., -/1/1944, *Webb* 116 (NH); Inanda to Drakensberg, *Buchanan* s.n. (NH); 26310, 26622A, 9748 (NH); *Carnegie* s.n. (NU); Natal, *Wood* s.n. (NU); *STE* 27438 (STE); Cape of Good Hope, -/1822, *Carmichael* s.n. (K); C.B.S., *Zeyher* s.n. (K); O.F.S., *Cooper* 1053 (K); Cape of Good Hope, -/3/1873, *Cooper* 2907 (K); Natal, *Buchanan* s.n. (K); Promontorio bonae Spei, *Gueinzus* s.n. (G); Port Natal, *Gueinzus* s.n. (C); Pr. b. Sp., *Gueinzus* s.n. e-h (S); Natal, on trees, *Sanderson* 14 (S); Cap b. Spei, *Warwa* 50—specimen in centre at bottom of sheet (W); Cap b. Spei, *Ecklon* s.n.; Cap b. Sp., *Bojer* s.n.; Cap b. Spei, *Ecklon & Zeyher* s.n.; Cap, *Drège* s.n.; Orange Free State, -/1862, *Cooper* 1053 (W).

3. *Elaphoglossum macropodium* (Fée) Moore, Ind. Fil.: 11 (1857). **Fig. 11A–F.**

Acrostichum macropodium Fée, Mém. Fam. Foug. 2: 30, t.6, f.2 (1845). Type: In Borbonia. in Herb. M. Bory de St. Vincent (P, holo.).

Icones: Fée, Mém. Fam. Foug. 2: t.6, f.2 (1845); Sim, Ferns S. Afr. ed. 2: t.148 (1915); Tardieu in Humbert Fl. Madagasc., Polypod. 2: t.9, f.3–4 (1960).

Rhizome widely creeping, branched, up to 6 mm diam., phyllopodia up to 25 mm long, black to grey, aerophores strongly developed, rhizome densely set with golden-brown, scariose, lanceolate scales with numerous long filamentous outgrowths along their margins, variable in size, up to 12 × 2,5 mm; stipes approximate, firm, pale brown, black at base, shallowly sulcate ventrally, trophophyll stipe up to 150 mm long, sporophyll stipe usually longer than that of trophophyll, up to 180 mm long, few ovate scales with short, more irregular filamentous outgrowths along margin, confined to stipe base, up to 10 × 2,5 mm; trophophyll simple, entire, coriaceous, narrow-elliptic to elliptic, obtuse to longly decurrent at base, up to 320 × 70 mm, venation free, ventral and dorsal surface with small sclerified substellate to stellate scales, scales on ventral surface often confined to lamina base; spo-

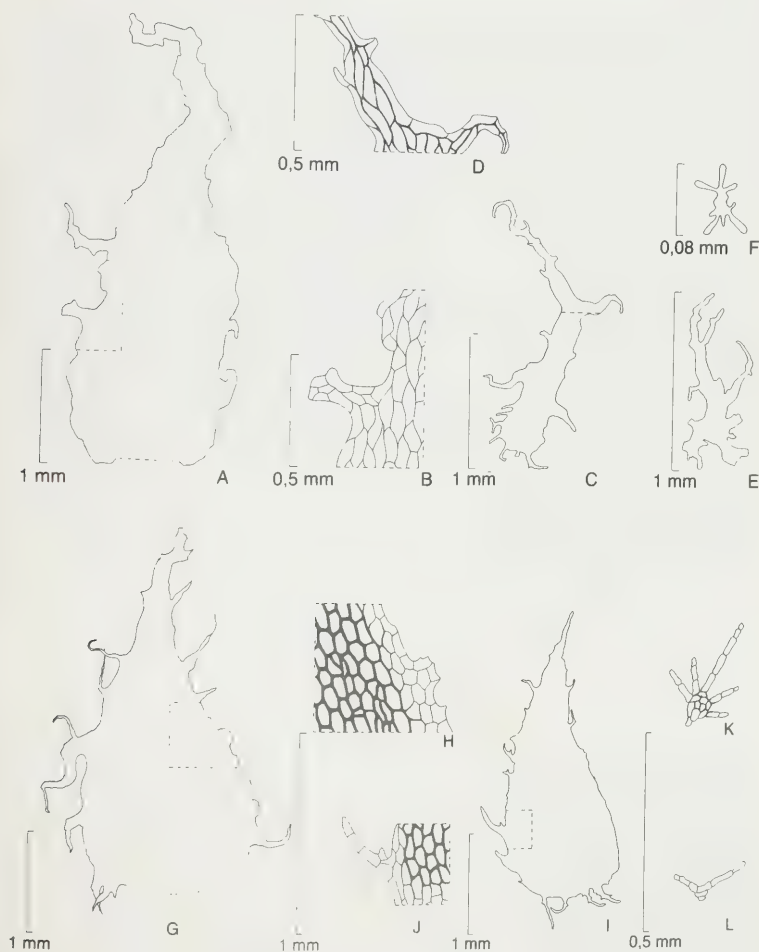


FIG. 11.

A-L. scales of *E. macropodium*, Roux 382 (NBG) and *E. angustatum*, Roux 773 (NBG). A-F, *E. macropodium*. A. rhizome scale; B. detail; C. stipe scale; D. detail; E and F. trophophyll scale from ventral surface. G-L, *E. angustatum*. G. rhizome scale; H. detail; I. stipe scale; J. detail; K and L. trophophyll scale from dorsal surface midrib.

rophyll simple, entire, coriaceous, narrow-lanceolate to narrow-elliptic, acute to obtuse or longly decurrent to base, midrib shallowly sulcate ventrally, up to 270×40 mm, venation free, ventral surface glabrous, dorsal surface with few sclerified, stellate scales along midrib; sori acrostichoid but often incomplete at base, annulus large, 10–12 (12)-celled, spores rotund, sporoderm forming short and long, narrow to broad, reticulate ridges up to $4 \mu\text{m}$ high, ridges and areas between with few spinules, variable in length, 27–30 μm diam.

PHYTOGEOGRAPHY AND ECOLOGY

The distribution of *Elaphoglossum macropodium* is more or less restricted to the Eastern Transvaal escarpment, the Natal midlands and the coastal regions of the Transkei (Fig. 13).

Precipitation recorded within the range of distribution varies annually from 1 750 mm (Graskop–2430 DB), to 1 240 mm (Port St. Johns–3129 DA). Mists are frequent within this area throughout the year.

Habitats in which *E. macropodium* usually occur are deeply shaded, moist, evergreen riverine or mountain forests where the plants are lithophytes or low-level epiphytes which often form extensive stands. Exposed plants, which are not commonly found, are usually depauperate.

Hemicryptophyte (litho- or epiphytic). Fronds meso- xeromorphic, articulated. Seasonal pattern unknown. Effective vegetative propagation by widely creeping branched rhizome. Sexual reproduction unknown to the author.

PHENOTYPE VARIATION

Variation within *E. macropodium* is more or less restricted to frond size and scale density on the lamina surfaces. Plants growing in exposed conditions tend to have lamina scales more sparsely set. Plants from xeric conditions have rhizome scales which are entirely sclerified, smaller and with less filamentous outgrowths, often becoming subentire.

Reticulate veins were observed in the trophophyll but this is sporadic.

MATERIAL EXAMINED

TRANSVAAL—2430 (Pilgrims Rest): Mariepskop, Graskop (-DB), -/4/1946, Schweickerdt 1630 (NU); Klaserie waterfall, Mariepskop, 6/1/1960, v. d. Schyff 4927 (W); Fairyland, Graskop (-DD), 6/1/1979, Roux 382 (NBG).

NATAL—2731 (Louwsburg): Ngome Forest, Ngotshe Distr. (-CD), 10/2/1962, Tinley 730 (NU); Ngome Forest, Ngotshe, 16/7/1956, Schelpe 6229 (K). —3130 (Port Edward): Beacon Hill East, Port Shepstone (-AA), 1/1/1967, Strey 7244 (NH).

TRANSKEI—3129 (Port St. Johns): South facing cliff near airstrip (-DA), 24/4/1979, Roux 586 (NBG).



FIG. 12.
E. angustatum, habit. Roux 773 (NBG).

4. *Elaphoglossum angustatum* (Schrad.) Hieron. in Bot. Jahrb. **46**: 404 (1911). Figs 11G–L and 12.

Acrostichum angustatum Schrad. in Gött. Gel. Anz.: 915 (1818). Type: Cap b. Sp., *Hesse s.n.* (GOET, holo.!).

Olfersia angustata (Schrad.) C. Presl, Tent. Pterid.: 234 (1836).

Acrostichum conforme Sw. var. *schraderii* Fée, Mém. Fam. Foug. **2**: 31 (1845). Type: as for *E. angustatum*.

Elaphoglossum conforme (Sw.) Schott var. *latifolium* Sim, Ferns S. Afr. ed. **2**: 286 (1915). Type: Inanda & Great Noodsberg, *Buchanan s.n.* (NH, lecto.!).

Rhizome widely creeping, branched, up to 8 mm diam., phyllopodia 3–7 mm long, black, aerophores small, rhizome densely set with pale brown, scariose, lanceolate scales with numerous filamentous outgrowths along the margin, up to $9 \times 1,5$ mm; stipe approximate, terete, firm, pale brown to green, trophophyll stipe up to 310 mm long, sporophyll stipe usually longer than trophophyll stipe, up to 350 mm long, with few deciduous, scariose, amorphous scales with few filamentous outgrowths along their margins, up to $3,5 \times 1,2$ mm; trophophyll simple, entire, firmly herbaceous, linear to narrow-elliptic, apex acute to obtuse, longly decurrent to base, up to 300×50 mm, venation free, midrib shallowly sulcate ventrally, ventral surface with few minute pale brown, substellate to filiform scales becoming more frequent near base and along midrib; sporophyll simple, entire, firmly herbaceous, narrow-elliptic, apex often obtuse, longly decurrent to base, up to 250×20 mm, venation free, midrib shallowly sulcate ventrally, ventral and dorsal surfaces with minute, pale brown, substellate to filiform scales along midrib; sori acrostichoid, annulus large, 12–13 (12)-celled; spore sporoderm with irregular, narrow, reticulate wings up to $4 \mu\text{m}$ high, crests finely fimbriate, wings and areas between are papillate, papillae often form small units, otherwise relatively smooth, $32\text{--}42 \mu\text{m}$ diam.

Elaphoglossum angustatum was not accepted as a valid taxon by numerous authors for many years. In most accounts (Fée, 1845; Moore, 1857; Christensen, 1905; Sim, 1892 and 1915) the taxon was referred to as a variety, form or even a synonym of *E. conforme*.

Pappe and Rawson (1858) followed Presl (1836) by referring the taxon to the genus *Olfersia*, Moore and Christensen bluntly placed *E. angustatum* as a form of *E. conforme* while Fée created a variety, var. *schraderii*, for the taxon.

Sim (1892) assigned material from Natal, collected by Buchanan and Wood, erroneously to the tropical American species *A. latifolium* Sw. However, in 1915, Sim realised this error and arbitrarily assigned the Natal speci-

men to a new var. *latifolium* under *E. conforme*, citing also a collection from Mt. Pene, Rhodesia (Zimbabwe).

Schelpé (1969) cited *E. conforme* var. *latifolium* Sim as a synonym of *E. macropodium*. The present author has however studied the Buchanan collection at Kew which has been cited by Schelpé as a syntype and has found it to be *E. angustatum*. The author also studied a Buchanan collection from Inanda and Great Noodsberg which is housed in the Natal Herbarium and he found that this too was a specimen of *E. angustatum*. The material in the Natal Herbarium, being made by the same collector from the same locality as was cited by Sim, is obviously the entire or part of the type collection.

The material from Mt. Pene has presumably either been lost or was not preserved as it could not be traced. The author therefore proposes the material in the Natal Herbarium as lectotype of *E. conforme* var. *latifolium*, and not the sheet at Kew which merely gives Natal as locality.

PHYTOGEOGRAPHY AND ECOLOGY

The distribution of *Elaphoglossum angustatum* is apparently confined to Table Mountain Sandstone and seems to be restricted to sheltered kloofs and ravines of the Cape mountains up to the Grootrivier (3323-CD). There is a distribution gap between the latter locality and the Natal coast. On Huntley's (748) specimen it is noted that the species grows on sandstone outcrops and only occurs on south-east facing areas at Port Edward (Fig. 13).

Over most of the range the species has been recorded from deeply shaded moist conditions such as cliffs, near waterfalls, on stream and river-banks as well as forest floors.

The climate over the range of *E. angustatum* is temperate and the species occurs well below the snowline. Rainfall varies from between 778 mm per annum at Knysna to 870 mm at Kranskop. Mists are frequent over the entire range of distribution.

Hemicryptophyte (terrestrial, litho- or epiphytic). Fronds meso- xeromorphic, articulated. Seasonal pattern irregular. Effective vegetative propagation by branched, creeping rhizome. Sporelings are also common on permanently moist mossy cliffs or boulders.

PHENOTYPE VARIATION

Extensive variation often occurs in frond size and shape. No influences can be identified which could cause such variation as it often occurs within a single population. A slight degree of variation in the density of scales on the lamina may also be distinguished.

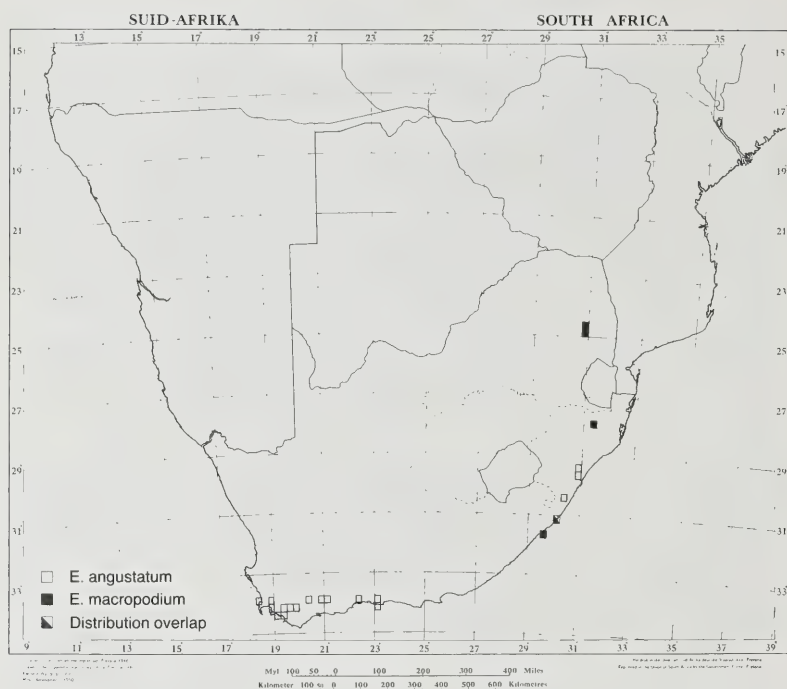


FIG. 13.
Distribution map of *E. macropodium* and *E. angustatum*.

MATERIAL EXAMINED

NATAL—2930 (Pietermaritzburg): Inanda & Great Noodsberg (-BD/-DB), *Buchanan s.n.* (NH); Noodsberg, NH 26393 (NH).

—3030 (Port Shepstone): Emisdale, Umgaye flat, Alexandra Country (-AD), 20/2/1910, *Rudatis* 608 (STE).

—3130 (Port Edward): Beacon Hill East (-AA), 8/2/1972, *Strey* 10619 (NH); Izingolweni road, Port Edward, *Huntley* 748 —top right and bottom left specimens only (BM, NU); Beacon Hill east, Port Shepstone, 1/1/1967, *Strey* 7244 (K).

CAPE—3318 (Cape Town): Nursery Gorge, above Kirstenbosch (-CD), 5/12/1976, *Roux* 76 (NBG); Table Mountain, -/2/1887, *Thode* 27436—two large specimens only (STE); Table Mountain, 2/6/1953, *Schelppe* 3898 (BM); Waterfall on Table Mountain, -/6/1847, *Prior s.n.* (K); Jonkershoek, second waterfall (-DD), 26/11/1942, *Rycroft* 606 (NU); Stellenbosch, tweede waterval, 24/5/1958, *Steyn* 12 (STE); Stellenbosch, tweede waterval, 24/5/1958, *Perold* 9 (STE).

—3320 (Montagu): Swellendam Forest Reserve, Marloth Reserve (-CD), 15/1/1970,

- Kruger 1042* (STE); Grootvaders Bosch, Heidelberg (-DD), 3/12/1958, *Barker 8825* (NBG); Strawberry Hill, Langeberg, -/12/1954, *Stokoe s.n.* (SAM).
 —3321 (Muiskraal): South-west of Aasvoëlkrantz, above Oudebosch (-CC), 7/6/1978, *Roux 281* (NBG).
 —3322 (Oudtshoorn): George (-CD), *Holland s.n.* (NBG); Hoogekraalsrivier, -/1838, *Drège s.n.* (BM); Krakakow, George, -/11/1947, *sine coll.* (K).
 —3323 (Willowmore): Deep Walls forest near Big Tree, Knysna (-CC), 3/10/1963, *Barker 9956* (NBG); Kleinbos, Buffelsnek, Knysna Div., 16/12/1953, *Schelpé 4315* (BM); Buffelsnek Forest Reserve, Knysna, 5/7/1960, *Schelpé 6553* (C); Knysna, *Britten s.n.* (GRA); Groot Rivier (-CD), 10/11/1951, *Taylor 3595* (NBG).
 —3418 (Simonstown): W. bank of Steenbras River, at waterfalls, (-BB), 4/3/1934, *Acock 4939* (S); Harold Porter Botanic Garden, Betty's Bay (-BD), 21/8/1979, *Roux 708* (NBG); Disa Kloof, Betty's Bay, 6/3/1961, *Rycroft 2268* (NBG, STE); Hangklip Gorge, Caledon, 4/9/1942, *Compton 13535* (NBG); Harold Porter Botanic Garden, 13/5/1963, *Topper 111* (NBG); Kogelberg State Forest, Koedoebos, 24/11/1972, *Boucher 2043* (STE); Kogelberg Forest Reserve, 12/5/1969, *Boucher 315* (STE).
 —3419 (Caledon): Zonder End (-AB), *Barnard 418* (SAM); In valley at Hermanus (-AC), -/10/1937, *Stander s.n.* (STE); Caledon (-AD), *Zeyher s.n.*—specimen on right (SAM); Rivier Sonder End mountains, Caledon Div. (-BA/-BB), -/6/1949, *Stokoe s.n.* (SAM); Kloof north of Riviersonderend (-BB), 14/6/1974, *Goldblatt 2058* (NBG).
 —3423 (Knysna): Lilyvlei near Knysna (-AA), 7/12/1936, *Linneberg s.n.* (S); Concordia, Knysna, 29/6/1944, *Rycroft 647* (NU).
 Without exact locality: NH 9746, 26622 (NH); *Barkly s.n.*, SAM 24976 (SAM); *Burchell* Cat Geog. Pl. Afr. Aust. 5851 (K); Cap, -/1845, *Drège s.n.* (G); Promontorium bonae Spei, *Gueinzus s.n.* (C); Cap bon. Sp., *Wolff s.n.* (C); Kap, *Zeyher s.n.* (S); Natal, *Wood s.n.* (S); e Cap b. Sp., *Wänman 35* (SBT); e Cap b. Sp., *Thunberg s.n.* (SBT); Cap b. Spei, *Roser s.n.*—except top central specimen (W); Natalia, *Gueinzus s.n.* (W); Baviaanskloof W 365246 (W); Cap b. Sp., *Ecklon s.n.* (W); Natal, *Buchanan s.n.* (K).

5. *Elaphoglossum spathulatum* (Bory) Moore, Ind. Fil.: 14 (1857).

Acrostichum spathulatum Bory, Voy. Quatre Princ. Iles 1: 363, t.20, f.1 (1804). Type: Réunion, R. St. Denis, *M. Bory de St. Vincent s.n.* (P, holo.). **Fig. 14A–F.**

Olfersia spathulata (Bory) C. Presl. Tent. Pterid.: 233 (1836).

Elaphoglossum ulugurense Reimers in Notizbl. Bot. Gart. Berl. 12: 80 (1934). Type: Uluguru gebirge: NO., Neberwald, 14/5/1933, *Schlieben 3931* (B, holo.!; BM, iso.).

Elaphoglossum spathulatum (Bory) Moore var. *ulugurense* (Reimers) Schelpé in Jl S. Afr. Bot. 30(4): 197 (1964).

Icones: Presl, Rel. Haenk. 1: t.2, f.1 (1826); Fée, Mém. Fam. Foug. 2: t.14, f.3 (1845); Sim, Ferns S. Afr., ed. 2: t.150, f.1 (1915); Vareschi in Fl. Venez., *Helechos* 1(2): t.165 (1969).

Rhizome creeping, up to 2 mm diam., densely set with pale brown, scarious, narrow-lanceolate, entire to shallowly dentate scales, often with few filamentous outgrowths at base, variable in size, up to 2 × 0.5 mm; stipe approximate, terete, firm, pale brown to green, trophophyll stipe up to 36 mm

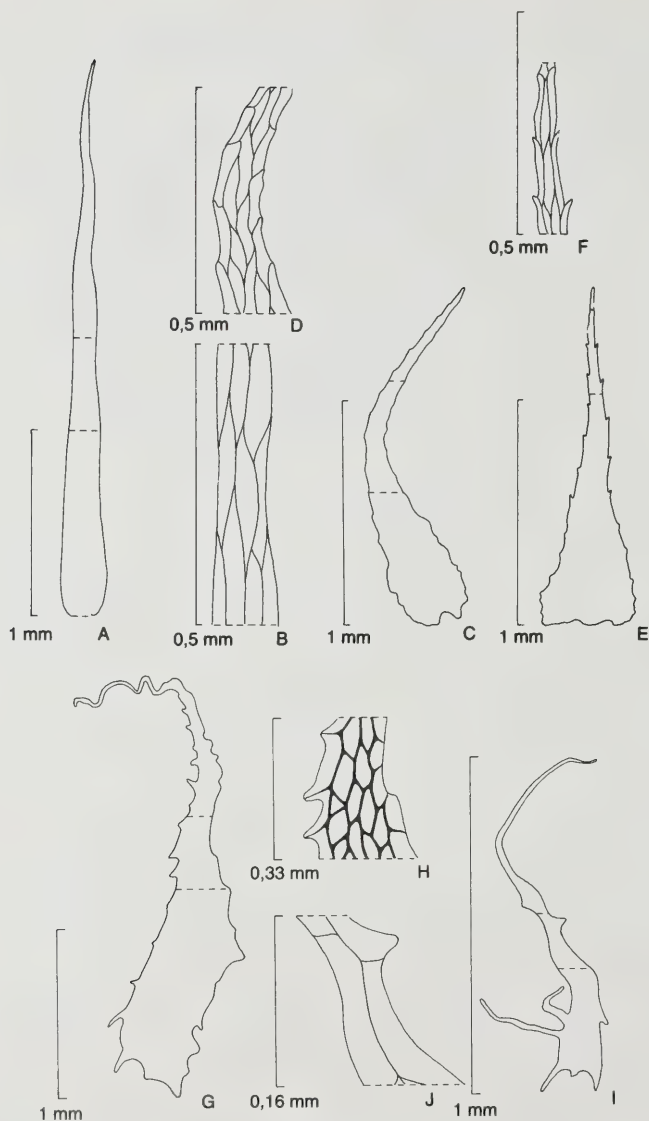


FIG. 14.

A–J, scales of *E. spathulatum*, Roux 970 (NBG) and *E. drakensbergense*, Roux 824 (NBG). A–F, *E. spathulatum*. A. rhizome scale; B. detail; C. stipe scale; D. detail; E. trophophyll scale from ventral surface; F. detail. G–J, *E. drakensbergense*. G. rhizome scale; H. detail; I. trophophyll scale from ventral surface; J. detail.

long, sporophyll stipe usually longer than that of the trophophyll, up to 60 mm long, densely set with scariose, narrow-lanceolate, entire to shallowly dentate scales with inrolled margins, variable in size, up to $2 \times 0,3$ mm; trophophyll simple, entire, herbaceous, spathulate to elliptic, cuneate to longly decurrent at base, up to 23×12 mm, venation free, ventral surface densely paleate with pale brown scariose, narrow-lanceolate, cordate, shallowly dentate scales with inrolled margins, up to $2 \times 0,4$ mm, dorsal surface scales similar to those on ventral surface but fewer and smaller, up to $1,5 \times 0,3$ mm; sporophyll simple, entire, firmly herbaceous with membranous margin, ovate to rotund, usually folded together along midrib, up to 11×10 mm, venation free, ventral surface scales less frequent than those on trophophyll, lanceolate, shallowly dentate, base sclerified, up to $2,5 \times 0,4$ mm, scales absent on dorsal surface; sori acrostichoid except for membranous margin of frond, annulus large, 11–12 (12)-celled; spores monolete, reniform to rotund, sporoderm with broad, low, reticulate ridges, except for a clearly defined straight central ridge, crests and areas between scabrous, $45\text{--}52\text{ }\mu\text{m}$ diam.

Acrostichum piloselloides C. B. Presl (type from Peru) has been cited by several authors (Christensen, 1905; Schelpe, 1969; 1970; Vareschi, 1969) as a synonym of *E. spathulatum*. Fée (1845), however accepted the species as distinct, and his illustrations of the two are very different. [Presl described specimens attributed to both species in his *Reliquiae Haenkeanae* (1825). The specimen which he identified as *E. spathulatum*, from the Philippines, was probably *E. blumeum* var. *philippinense* Holttum, Flora Malesiana Ser. II, 1(4): 311 (1978); he saw no specimens from Réunion, as Luzon was the westward limit of Haenke's journey.] The present author has therefore deleted *E. piloselloides* as a synonym of *E. spathulatum*, but he has not studied Presl's type which is probably in one of the two herbaria at Prague (see Holttum's report of 1969 on Presl's types, in which *E. piloselloides*, being a tropical American species, is not mentioned).

PHYTOGEOGRAPHY AND ECOLOGY

Elaphoglossum spathulatum has a restricted distribution within the political boundaries of South Africa. The distribution is largely influenced by the geology, which has resulted in the much dissected topography of the Natal Drakensberg and the north-eastern corner of the Orange Free State. Cave Sandstone, which is overtopped by a layer of basalt several thousand metres thick, forms the prominent geological formation (Fig. 15).

Precipitation at Witsieshoek (alt. 1 699 m), measures 811 mm per annum. Higher up the rainfall will presumably be much more. Several sn...

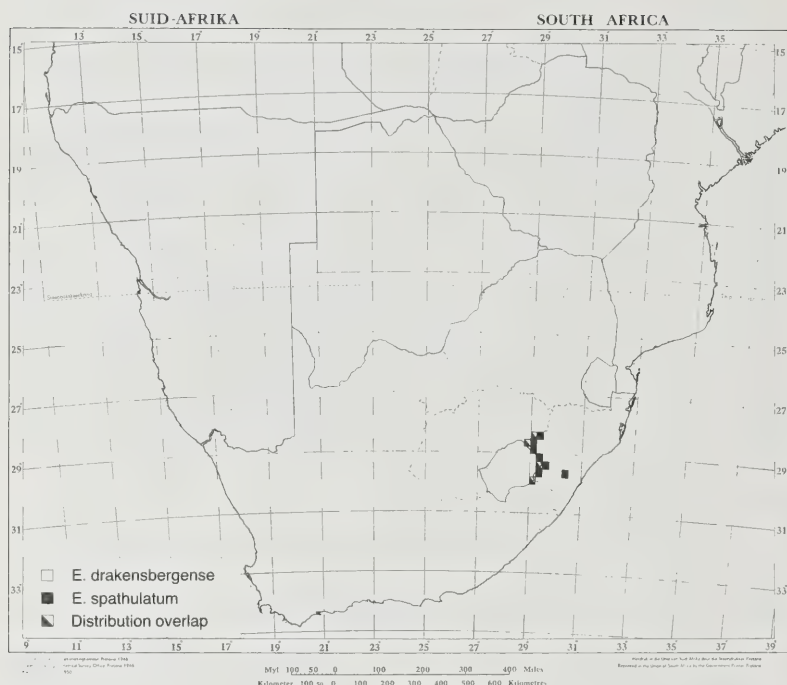


FIG. 15.
Distribution map of *E. spathulatum* and *E. drakensbergense*.

falls occur annually between June and September, but more so at altitudes above 2 100–2 500 m. Mists are frequent throughout the year.

The habitat with which *E. spathulatum* is usually associated is deeply shaded conditions in seasonally wet evergreen riverine forests.

Hemicyptophyte (geo- or lithophytic). Mesophilous, fronds meso- xeromorphic, articulated. Seasonal pattern irregular. Vegetative propagation by short, branched creeping rhizome. More effective propagation however takes place through spores. Sporelings are commonly found with mature plants on mossy rock faces.

PHENOTYPE VARIATION

Except for a slight degree of variation in frond size and shape, no other form of variation was observed within the species.

MATERIAL EXAMINED

ORANGE FREE STATE—2829 (Harrismith): Farm Bosch Hoek, east of Man-yenzeza (-AD), 12/12/1980, *Roux* 885 (NBG); Van Reenen, 2/3/1895, *Schlechter* 6919 (G, K); Farm Klavervlei (-CA), 11/12/1980, *Roux* 882 (NBG).

NATAL—2828 (Bethlehem): Royal Natal National Park, gorge (-DB), 5/5/1967, *Strey* 7476 (NH); Near Sunday Falls, Royal Natal National Park area, 6/11/1946, *Schelpé* 1814 (NH); Duivels Hoek, Mont-aux-Sources area, 6/4/1946, *Schelpé* 1462 (NU).

—2829 (Harrismith): Van Reenen's Pass (-AD), -/2/1908, *Thode* 4184 (STE); Oliviershoek Pass (-CA), -/2/1900, *Thode* 5232 (STE); Little Switzerland, Oliviershoek, 16/3/1981, *Roux* 970 (NBG); Rainbow Gorge, Cathedral Peak area (-CC), 14/4/1978, *Cowan* 70 (NU); nKdhlahla Forest, Cathedral Peak area, -/2/1943, *Schelpé* p. 21 (NU); Cathedral Peak area, -/7/1944, *Esterhuysen* 10208 (NBG); Rainbow Gorge, Cathedral Peak area, 18/4/1978, *Cowan* 92 (NU); Umlambanja Forest, Cathedral area, -/1944, *Schelpé* 391 (NU); Between Camel and Pyramid, Cathedral area, -/7/1944, *Schelpé* 678 (NU).

—2929 (Underberg): Injasuti area, Natal (-AB), *Esterhuysen* 26046 (K); Cathkin Peak Ravine, *Strey* 7812 (NH); Giants Castle, Natal, -/1906, *Sim* s.n. (NU); Caves Forest, Giants Castle (-BC), 12/1/1979, *Roux* 421 (NBG); Upper Polela Cave, Cobham Forestry Reserve (-CB), 15/2/1979, *Hilliard & Burt* 12607 (NU).

—2930 (Pietermaritzburg): Zwartkop, Pietermaritzburg Distr. (-CB), -/1/1916, *Carnegie* s.n. (NU).

Without exact locality: NH 9747—small specimen on right (NH); *Barkly* s.n., SAM 24993 (SAM); Natal, *Buchanan* s.n. (K); Cape of Good Hope, -/1862, *Cooper* s.n. (K); Natal, -/1868, *McKen* s.n. (K); Natal, *Barkly* 141 (GRA).

6. *Elaphoglossum drakensbergense* Schelpé in Jl S. Afr. Bot. 34(4): 237 (1968). Type: Natal, Escort Distr., Drakensberg, Injasuti area. *Esterhuysen* 26052 (BOL, holo.; BM, C, K, iso.!). Figs 14G–J and 16.

Rhizome creeping, up to 2.5 mm diam., phyllopodia up to 4 mm long, dark brown to black, lacking aerophores, densely set with pale to dark brown, scariose, narrow-lanceolate scales up to 5×0.5 mm; stipe approximate, terete, firm, trophophyll stipe up to 78 mm long, sporophyll stipe usually longer than that of trophophyll, up to 92 mm long, densely set with pale brown, scariose, narrow-lanceolate scales which are shallowly dentate or with a few long filiform outgrowths along the margin, up to 3×0.3 mm; trophophyll simple, entire, herbaceous, broad-elliptic to ovate or spatulate, up to 60×13 mm, venation free, ventral surface densely set with pale brown, scariose, lanceolate attenuate scales, entire or shallowly dentate, peltate scales varying much in size, up to 1.5×0.2 mm, dorsal surface glandular, with scales similar to that of ventral surface along midrib, otherwise scaleless; sporophyll simple, entire, herbaceous, narrow-elliptic to ovate, up to 30×10 mm, ventral surface densely set with pale brown, scariose lanceolate attenuate scales with few long filiform outgrowths along margin, peltate scales varying much in size, dorsal surface with few scales along midrib similar to that on ventral surface; sori acrostichoid, annulus large, 12–14 (12)-celled, spores monolete, reniform to rotund, sporoderm with low, sho-

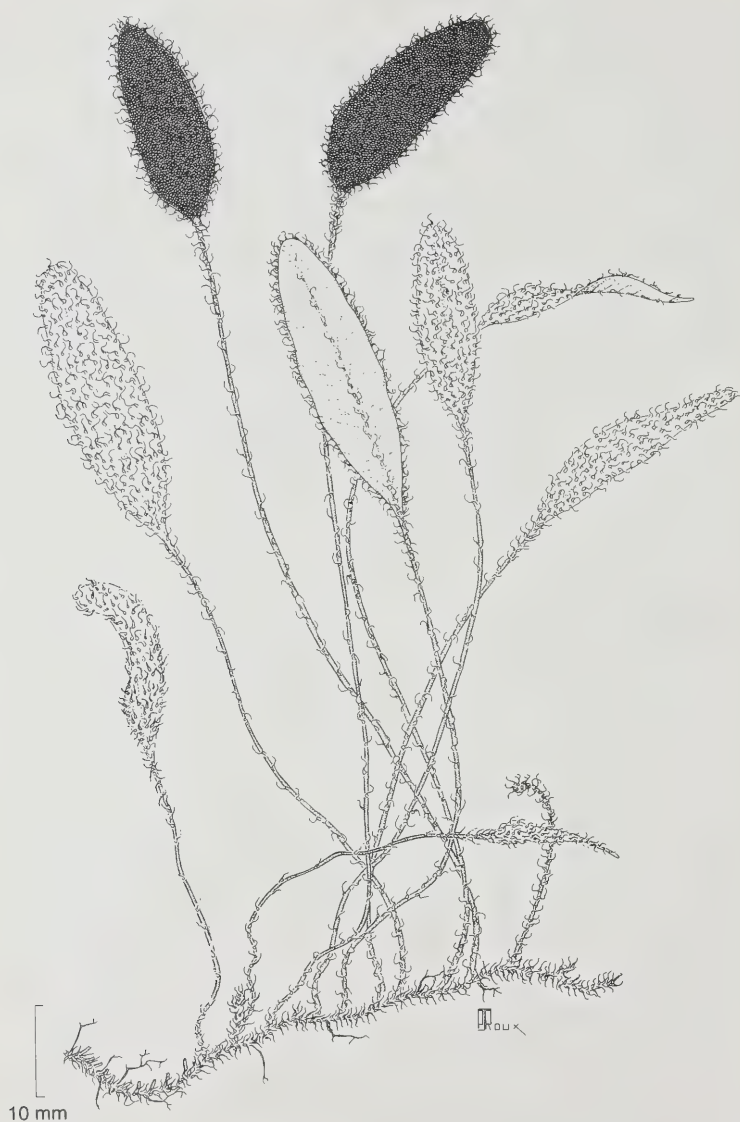


FIG. 16.
E. drakensbergense, habit, scales not exhibiting detail. Roux 824 (NBG).

or long reticulate ridges, except for a clearly defined straight central ridge, crests and areas between spinulose, variable in size and density, 45–50 μm diam.

PHYTOGEOGRAPHY AND ECOLOGY

Elaphoglossum drakensbergense is restricted to the Natal Drakensberg and the mountainous north-eastern corner of the Orange Free State.

Cave Sandstone and basalt form the major geological formations within the range of distribution which is largely restricted to altitudes between 2 100 and 3 000 m (Fig. 15).

Precipitation at Cathedral Peak measures 1 262 mm per annum which is reduced to a mere 777 mm per annum on Platberg, the most northern known limit of its distribution. Regular snowfalls occur annually between June and September. Mists are also frequent throughout the year.

E. drakensbergense occurs in relatively dry as well as exposed conditions. Collections have been made from dryish rock overhangs, and rock crevices, as well as low cliffs among grass tussocks.

Hemicryptophyte (geo- or lithophytic). Meso- xerophilous, fronds meso-xeromorphic, poikilohydrous, articulated. Seasonal pattern irregular. Effective vegetative propagation by creeping rhizome.

PHENOTYPE VARIATION

Variation is more or less restricted to frond size. Scales on the dorsal surface of the trophophyll are usually restricted to the midrib but it was noticed that scales, although few, also occur on the lamina. Such scales usually occur close to the midrib and the margin.

The glands on the dorsal surface of the trophophyll are more conspicuous in young living material. However, this character is not always lost in herbarium specimens.

MATERIAL EXAMINED

ORANGE FREE STATE—2828 (Bethlehem): In cave on south-east facing cliff near Sentinel (-DB), 14/4/1981, *Roux 971* (NBG).

—2829 (Harrismith): On upper plateau of Platberg (-AC), 22/1/1981, *Roux 824* (NBG); Donkey's Pass, Platberg, 28/6/1980, *Roux 800* (NBG).

NATAL—2929 (Underberg): Langalibalele Pass, Giants Castle National Reserve (-AD), 21/4/1979, *Cowan 164* (NU); Mooi River, Natal, *Bell s.n.* (K); Bushman's Nek Pass, Underberg Dist., (-CC), 7/7/1979, *Cowan 165* (NU); Thamaltea Cave, Bushman's Nek, Underberg Dist., 6.2.1976, *Hilliard & Burt 8997* (NU).

Without exact locality: NH 9747—large specimen on left (NH).

7. *Elaphoglossum aubertii* (Desv.) Moore, Ind. Fil.: 5 (1857). Fig. 17A–F.

Acrostichum aubertii Desv. in Mag. Ges. Naturf. Berl. 5: 309 (1811).
Type: In Insula Borboniae. *Aubert du Petit-Thouars s.n.* (P, holo.).

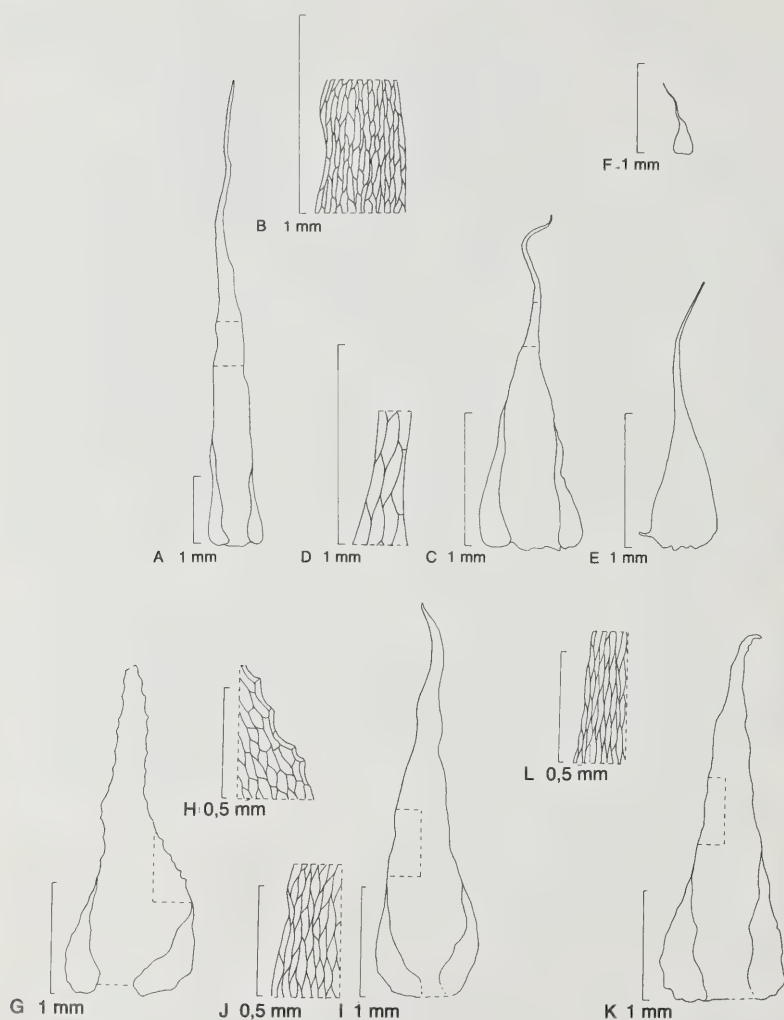


FIG. 17.

A–L, scales of *E. aubertii*, Roux 988 (NBG) and *E. hybridum*, SAM 24988 (SAM). A–F, *E. aubertii*. A. rhizome scale; B. detail; C. trophophyll stipe scale; D. detail; E. midrib scale from dorsal surface of trophophyll; F. lamina scale from dorsal surface of trophophyll. G–L, *E. hybridum*. G. rhizome scale; H. detail; I. trophophyll stipe scale; J. detail; K. trophophyll lamina scale; L. detail.

Acrostichum lineare Fée, Mém. Fam. Foug. 2: 47, t.15, f.2 (1845). Type: Mont d'Organi, Brasil, Gardner 98 (G, holo.!; BM, K, iso.).

Elaphoglossum lineare (Fée) Moore, Ind. Fil.: 11 (1857).

Acrostichum boivinii Mett. ex Kuhn, Fil. Afr.: 43 (1868). Type: Ins. Mauritii, Boivin s.n. (W, holo.).

Icones: Fée, Mém. Fam. Foug. 2: t.18, f.1 (1845); Sim, Ferns S. Afr., ed. 2: t.152 (1915); Tardieu in Humbert Fl. Madagasc., Polypod. 2: t.14, f.4-7 (1960); Tardieu in Aubréville, Fl. Cameroun 3: t.47, f.5-8 (1964).

Rhizome short; creeping, up to 6 mm diam., phyllopodia up to 3 mm long, black, aerophores narrow, forming a wing which often extends beyond the point of articulation, rhizome densely set with dark brown lanceolate scales with few filamentous outgrowths at the base, variable in size, up to $5 \times 0,8$ mm; stipes caespitose, firm, shallowly sulcate ventrally, trophophyll stipe up to 150 mm long, sporophyll stipe usually longer than that of the trophophyll, up to 250 mm long, densely set with pale brown scarioso lanceolate to narrow-lanceolate entire scales, variable in size, often reduced in number to the base of lamina, up to $4 \times 0,8$ mm; trophophyll simple, entire to shallowly crenulate, herbaceous, linear, attenuate to apex, longly decurrent to cuneate at base, midrib shallowly sulcate ventrally, up to 345×20 mm, venation free, ending in hydathodes near margin, ventral surface with numerous lanceolate to narrow-lanceolate scales, margins inrolled, variable in size, up to $1,2 \times 0,4$ mm, dorsal surface with stellate to lanceolate scales with filamentous outgrowths at base, margins inrolled, up to $6 \times 0,4$ mm, frequent; sporophyll simple, entire, herbaceous, lanceolate to linear, acute, base often oblique, midrib shallowly sulcate ventrally, up to 95×20 mm, venation free not ending in hydathodes, ventral surface glabrous; sori wholly acrostichoid, annulus large, 12-celled.

The frond scales of the type of *Acrostichum lineare* Fée are slightly more sclerified and the fronds much narrower than the condition usually found in *E. aubertii*. The stipes of the sporophylls tend to be very glabrous. A few scales however do occur here. Species status cannot be given to a taxon which varies in such a slight degree from *E. aubertii*.

PHYTOGEOGRAPHY AND ECOLOGY

The distribution of *Elaphoglossum aubertii* in South Africa is restricted to the Eastern Transvaal escarpment and the Natal midlands (Fig. 18).

Rainfall, although predominantly seasonal (October-April), may occur throughout the year. At Graskop the annual precipitation measures 1 340 mm while at Pietermaritzburg it measures 1 176 mm. Dense mists are frequent throughout the year.

E. aubertii is confined to deeply shaded, moist evergreen riverine

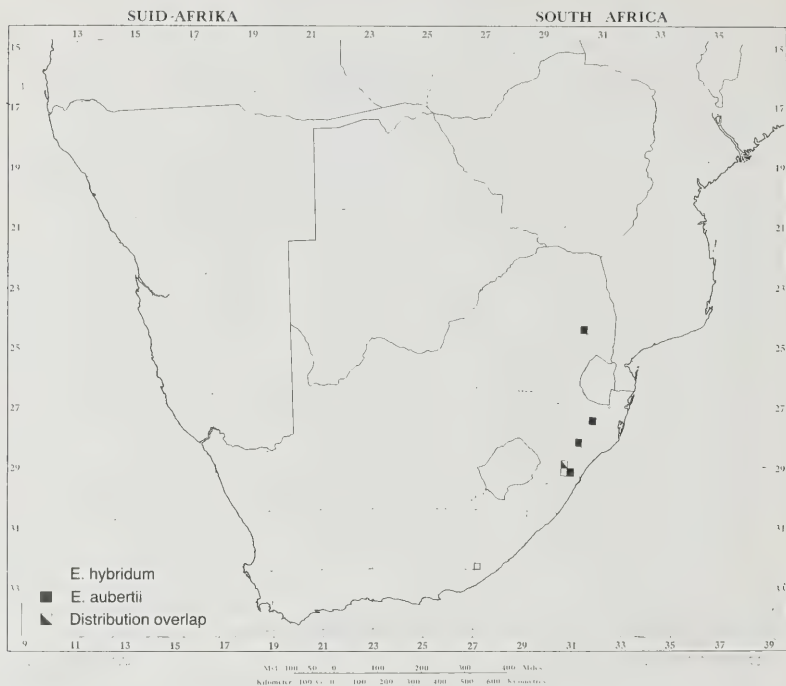


FIG. 18.
Distribution map of *E. aubertii* and *E. hybridum*.

mountain forests. Plants occur singly or as a few individuals grouped together on damp mossy boulders near the water.

Hemicryptophyte (lithophytic). Fronds mesomorphic, articulated, seasonal pattern apparently irregular. Sporophylls collected in February, March, July and December. Propagation by branching rhizome. Sexual propagation was not observed by the author.

PHENOTYPE VARIATION

Variation of significance in *E. aubertii* is more or less restricted to frond size and shape.

MATERIAL EXAMINED

TRANSVAAL—2430 (Pilgrims Rest): Fairyland, Graskop (-DD), 6/1/1979, Roux 381 (NBG).

NATAL—2731 (Louwsburg): Ngome forest, Zululand (-CD), 23/3/1952, *Johnstone* 613 (NU).

—2830 (Dundee): Nkandhla, Qudeni Forest (-DB), 17/7/1956, *Schelte* 6262 (BM); Qudeni, Zululand, 15/2/1945, *Clarkson* 72 (NU); Qudeni, 15/2/1945, *Fisher* 814 (BM, NH); Qudeni, Zululand, 15/2/1945, *Allop* 739 (NU).

—2930 (Pietermaritzburg): "Branholme", Karkloof (-AD), -/5/1951, *Nixon* K. 136 (NH); Ehlatini Karkloof, 19/12/1965, *Moll* 2885 (NU); Karkloof forest, Lions River Distr., -/7/1961, *Farquharson* s.n. (NU); Karkloof, *Buchanan* s.n. (NH); Town Bush Valley, Pietermaritzburg (-CB), -/3/1944, *Schelte* s.n. (NU); Pietermaritzburg, *Guthrie* s.n. (SAM); Umlaas Natalensium (-DA), *Wood* s.n. (SAM).

Without exact locality: *Barkly* s.n. SAM 24991 (SAM); NH 9749, 26624 (NH); STE 27435 (STE); Zululand, *Rawson* 2994 (BM); Zululand, -/1864, *Gerrard* 1565 (K); Natal, *Barkly* 140 (GRA).

8. *Elaphoglossum hybridum* (Bory) Brack., U.S. Expl. Exped. 16: 69 (1854). Fig. 17G-L.

Acrostichum hybridum Bory, Voy. Quatre Princ. Iles 3: 95 (1804). Type: Réunion, Caverne Le Gentil, *M. Bory de St. Vincent* s.n. (P, holo.).

Acrostichum ciliatum Desv. in Mag. Ges. Naturf. Berl. 5: 310 (1811). Type: Réunion, *Commerson* s.n. in Herb. Jussieu (P, holo.).

Acrostichum ciliare Carm. in Trans. Linn. Soc. Lond. 12: 510 (1818) non Thouars (1804). Type: Tristan da Cunha, *Carmichael* s.n. (K, holo.).

Acrostichum tricholepis Bak. in Jl. of Bot. 29: 5 (1891). Type: Madagascar, Bé Kilus Mountains, *Last* s.n. (K, holo.).

Elaphoglossum tricholepis (Bak.) C. Chr., Ind. Fil.: 317 (1905).

Acrostichum hybridum (Bory) Brack. var. *vulcani* Fée, Mém. Fam. Foug. 2: 41, t.9, f.3 (1845). Type: Habitat in Borbonia, *Lepervanché* s.n. (P, holo.).

Elaphoglossum hybridum (Bory) Brack. var. *cuneatum* Bonap. in Not. Pterid. 14: 419 (1923). Type: De Nioumbadjou, Iles Comores, *Humbert* s.n. (P, holo.).

Icones: Fée, Mém. Fam. Foug. 2: t.9, f.3-4 (1845); Sim, Ferns S. Afr., ed. 2: t.151, f.1a (1915); Tardieu in Aubréville, Fl. Cameroun 3: t.47, f.1-4 (1964).

Rhizome short, creeping, up to 7 mm diam., densely set with dark brown sclerified, narrow-lanceolate to cordate, entire or shallowly crenate scales, often with few filiform filamentous outgrowths near base, up to 3×0.5 mm; stipe caespitose, firm, pale brown shallowly sulcate ventrally, trophophyll stipe up to 170 mm long, sporophyll stipe usually longer than that of trophophyll, up to 235 mm long; sclerified, narrow-lanceolate entire scales with in-rolled margins frequent along the stipe of the trophophyll, up to 4×0.3 mm; trophophyll simple, entire to shallowly undulate, herbaceous, broad to narrow-lanceolate or linear-acuminate, base cuneate to obtuse, up to 210×50 mm, venation free, often reticulate, ventral surface with sclerified, entire, narrow-lanceolate and minute stellate scales, up to 0.1 mm diam., narrow-

lanceolate scales more commonly confined to midrib of ventral and dorsal surfaces, continuous along margin, stellate scales absent on dorsal surface; sporophyll simple, entire, herbaceous, lanceolate, base obtuse to acute, up to 100×20 mm, venation reticulate, ventral and dorsal surfaces with few narrow-lanceolate, entire, sclerified scales along midrib; sori acrostichoid except for membranous margin, annulus cells small, 12-celled.

The type material of *E. tricholepis* is a mixed collection. The smaller specimen on the sheet appears to be *E. phanerophlebium*.

A label in the hand of Lepervanché which is attached to the type sheet of *A. hybridum* var. *vulcani* indicates that he was unable to determine the plant positively due to a lack of sufficient material in his herbarium. He further wrote that if the plant was distinct he would like to call it *vulcani* as it was collected at a high altitude on the exposed inner basalt cliff of the volcano on Réunion. The epithet *vulcani* was published with varietal rank by Fée, who attributed it to Lepervanché; the specimen is however only a depauperate form of *E. hybridum* (Fig. 19).



FIG. 19.

Holotype of *E. hybridum* var. *vulcani* Fée in the Museum of Natural History, Paris.

MATERIAL EXAMINED

NATAL—2930 (Pietermaritzburg): Karkloof (-AD), *Brown s.n.*, *Wylie s.n.*, NH 7424, *Buchanan s.n.*, NH 26737 (NH); Buccleuch, Natal, -/-/1914, *Sim s.n.* (GRA); Hilton Road, Natal (-CB), -/4/1946, *Slinger 48* (NH).

CAPE—3227 (Stutterheim): Peri, prope Kingwilliamstown (-CC), -/3/1892, *Sim s.n.* (G, K, W).

Without exact locality: NH 9743, 26623 (NH); In humidis rupestribus montis Drakensberg pone Tenam Natalensium, *Buchanan s.n.* (SAM); *Barkly s.n.*, SAM 24988 (SAM); Natal, *Buchanan 134* (K); Drakensberg, Natal, *Bell s.n.* (K); Natal, *McKen s.n.* (K); Natal, *Rehman s.n.* (P).

ACKNOWLEDGEMENTS

I would like to express my sincerest thanks to the Curators of GRA, NBG, NH, NU and STE who most kindly made material available to me. My thanks also goes to the Directors and members of staff at B, BM, BR, C, G, GOET, K, L. P, SBT, UPS and W who so generously made their herbaria and other facilities available to me when visiting their Institutes.

My sincerest thanks also goes to Prof. Holttum for critical comments and for drawing my attention to literature which otherwise would have been overlooked.

Lastly to Dr. D. Crawford and Mr. D. Gernecke of the Electron Microscope Unit at the University of Cape Town who most kindly did the scanning of the illustrated spores.

REFERENCES

- ADAMSON, R. S., 1942. Some changes in nomenclature III. *Jl S. Afr. Bot.* **8**(4): 271–272.
- ALSTON, A. H. G., 1956. The subdivision of the Polypodiaceae. *Taxon* **5**: 23–25.
- BELL, P. R., 1950. Studies in the genus *Elaphoglossum*. 1. Stelar structure in relation to habit. *Ann. Bot.*, N.S. **14**: 545–555.
- , 1955. Ibid. IV. The morphological series in the genus and their phylogenetic interpretation, part 1. *Ann. Bot.*, N.S. **19**: 173–199.
- BOWER, F. O., 1923 and 1928. *The Ferns (Filicales)*. Vols. I and III. Cambridge: Cambridge University Press.
- CHRIST, H., 1899. Monographie des Genus *Elaphoglossum*. *Neue Denkschr. allg. schweiz. Ges. Naturw.* **36**.
- CHRISTENSEN, C., 1905. *Index Filicum*. København: Hagerup.
- , 1938. Filicinae. In: Verdoorn, F. (ed.), *Manual of Pteridology*: pp. 522–550. The Hague: Nijhoff.
- COPELAND, E. B., 1947. *Genera Filicum*. Waltham, Mass.: Chronica Botanica Co.
- FÉE, A. L. A., 1845. Histoire des Acrostichées. *Mémoires sur la famille des Fougères*. Strasbourg: Berger-Levrault.
- , 1852. Histoire des Antrophyées. *Mémoires sur la famille des Fougères*. Paris.
- HOLTTUM, R. E., 1947. A revised classification of Leptosporangiate ferns. *J. Linn. Soc. (Bot.)* **53**: 123–158.

- , 1966. Florae Malesianae Precursores XLIV. The fern genus *Elaphoglossum* in Malesia, with descriptions of new species. *Blumea* **14**(2): 317–326.
- , 1968. *Flora of Malaya: Ferns*. ed. 2: pp. 17–29. Singapore: Government Printing Office.
- , 1969. A commentary on some type specimens of ferns in the Herbarium of K. B. Presl. *Novitates Bot. Inst. Bot. Univ. Carol. Prag.* **1968**: 3–56.
- HOOKE, W. J. and BAKER, J. G., 1865–68. *Synopsis Filicum*. London: Hardwicke.
- LIEW, F. S., 1977. Scanning electron microscopical studies on the spores of Pteridophytes: Oleandraceae. *Gdns' Bull., Singapore* **30**: 101–110.
- LOVIS, J. D., 1977. Evolutionary patterns and processes in ferns. In: Preston, R. D. and Woolhouse, H. W. (eds.), *Advances in Botanical Research*. Vol. 4: pp. 230–402. London: Academic Press.
- MICKEL, J. T., 1980. Relationship of the dissected Elaphoglossoid ferns. *Brittonia* **32**(2): 109–117.
- and ATEHORTÚA, L., 1980. Subdivision of the genus *Elaphoglossum*. *Am. Fern. J.* **70**(2): 47–68.
- MOORE, T., 1857–62. *Index Filicum*. London: Pamplin.
- PAPPE, L. W. and RAWSON, W., 1858. *Synopsis Filicum Africae australis*. Cape Town: W. Brittain.
- PICHI SERMOLLI, R. E. G., 1968. Adumbratio Florae aethiopicae 15. Elaphoglossaceae. *Webbia* **23**: 209–246.
- PRESL, C. B., 1825. *Reliquiae Haenkeanae*. 1 (1). Pragae: Calve.
- , 1836. *Tentamen Pteridographiae*. Pragae: Haase.
- SCHELPE, E. A. C. L. E., 1964. Pteridophyta collected on an expedition to Northern Mozambique. *Jl S. Afr. Bot.* **30**(4): 177–200.
- , 1969. Reviews of Tropical Africa Pteridophyta 1. *Contr. Bol. Herb.* **1**: 25–43.
- , 1970. *Flora Zambesiaca, Pteridophyta*. London: Crown Agents.
- SCHOTT, H., 1834. *Genera Filicum*. Wien: Wallishausser.
- SIM, T. R., 1892. *The Ferns of South Africa*. ed. 1. Cambridge: University Press.
- , 1915. *The Ferns of South Africa*. ed. 2. Cambridge: University Press.
- SMITH, J., 1841. On the genera of ferns. *Hook. Jl. of Bot.*: 148.
- VARESCHI, V., 1968. Flora de Venezuela. *Helechos* **1**(2): 809.
- WAGNER, JR., H. W., 1952. Types of foliar dichotomy in living ferns. *Am. J. Bot.* **39**(8): 578–592.
- and WAGNER, F. S., 1977. Fertile-sterile leaf dimorphy in ferns. *Gdns' Bull., Singapore* **30**: 251–267.